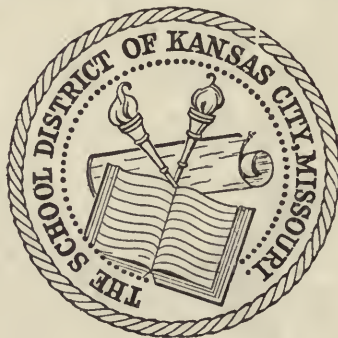


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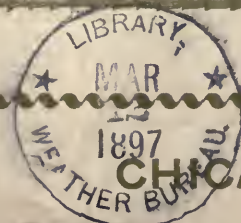


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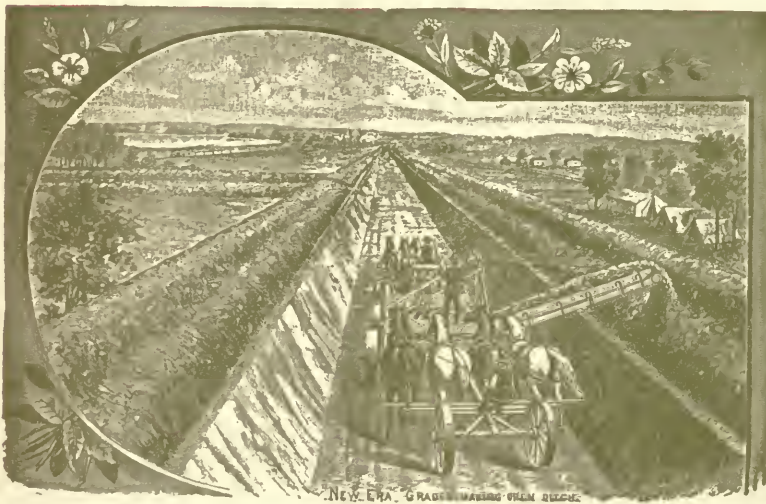
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if in the world. A beet sugar factory, with a daily capacity of 225 tons of beets, is being built at Eddy, and will be in operation November 1, 1896. To supply this factory the farmers of the Valley are now putting in fully 2,500 acres of beets, for which the sugar factory has contracted to pay \$4 per ton delivered at any station on the Pecos Valley Railway, the company paying the freight to the factory. At this price, and with the large yield per acre in the Pecos Valley, the farmer should clear all the way from \$35 to \$75 per acre from his crop of beets.

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THE IRRIGATION AGE.

VOL. XI.

CHICAGO, JANUARY, 1897.

NO. 1

THE PROGRESS OF WESTERN AMERICA.

Irrigation in the Message of the Governor of Wyoming.

The message of Governor Wm. A. Richards, of Wyoming, to the legislature which convened Jan. 12, is a timely and valuable addition to the irrigation literature of this country, and an event of no mean importance in the settlement and development of the arid West. So far as our information goes, he is the first Governor of an arid State to give agricultural development the foremost place in a legislative message, and is the first to consider not material results, but the betterment of institutions, on which the enduring success of irrigated agriculture must ultimately depend. In this message he shows clearly the importance of the grazing lands as a factor in promoting the reclamation and profitable use of the irrigable lands. This is a phase of the irrigation problem, which has been generally neglected and overlooked. It is our belief that many of the facts which he cites are not only new to nine-tenths of the people of this country, but the majority of our congressional law-makers as well.

Some of these are worth summarizing:

First: Four-fifths of the state of Wyoming is grazing land. It can never be reclaimed and its only value so far as agriculture is concerned, is the pasturage it affords.

Second: This land is now an open common. Those who use it pay nothing to the state or nation for the privilege. There is no incentive to its improvement,

but on the contrary, the absence of any law providing for its occupation or disposal makes such improvement impossible.



W. A. RICHARDS, Governor of Wyoming.

Third: The growth of settlement is increasing the number who desire to use this land, and is producing various controversies and conflicts over its occupation. It has already resulted in overstocking and the destruction of the native grasses, in many sections and is steadily impairing its pasturage value.

Some Recommendations. The Governor commends that the land laws be so changed that settlers on irrigated land can have the right to lease a small portion of the contiguous grazing land. Believing that the state governments are entitled to the proceeds of these leases, and they can manage these lands better than it can be done from Washington, he recommends that the arid states be given control of all the undisposed public lands within their border, and be authorized to lease the grazing land to the settlers at a low rental. He supports his recommendation by the following argument.

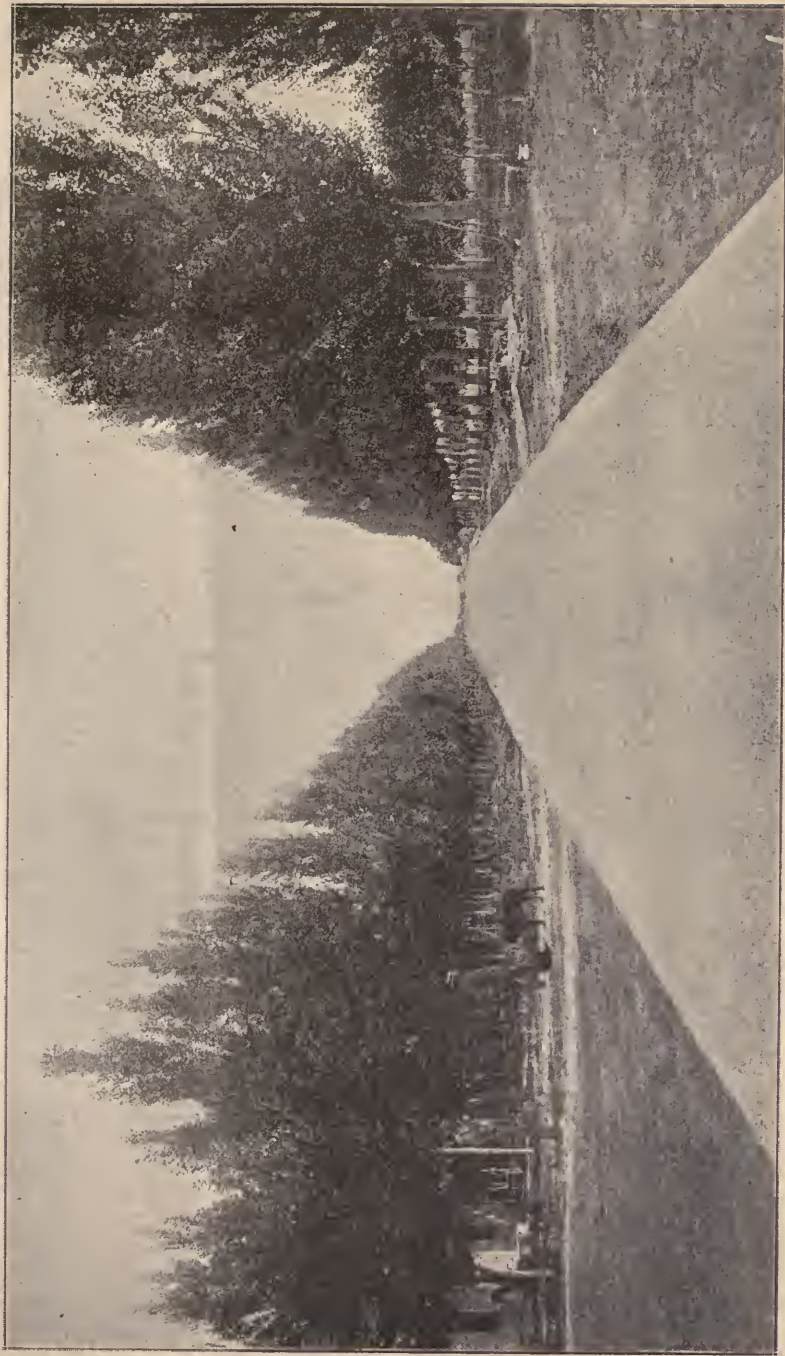
Whatever may be thought of the expediency of this action, there can be no difference of opinion as to the evils of our present land system, or of the policy of inaction and neglect, which has thus far characterized the national administration of the arid public domain. It is subjecting the mountain forests to accelerated devastation by fire and threatens the complete destruction of the native grasses on the plains, through restocking and improvident use. Such a policy imperils both the growth and ultimate success of irrigated agriculture in the arid states. It is a continuation of the policy which permitted and encouraged thousands of honest homeseekers with energy in their bodies and hope in their hearts, to attempt to make homes in the semi-arid region, where the climatic conditions made it hopeless from the outset. The privation and misery, the wasted lives, the millions of dollars expended and lost in this useless attempt to extend a humid agriculture into a region of inadequate rainfall, all had its primary origin in the inducement and deception of the homestead law. The people who settled the semi-arid plains thought they were the recipients of the nation's liberality. They were really the victims of its neglect.

We do not want this repeated in the arid states. Congress should either create an arid land system or it should place the states in a position to do so. The views of *THE AGE* were expressed in the December number.

They are in thorough accord with the recommendations of Governor Richards. Few men are better fitted by experience

and training to deal with this question than the executive of Wyoming. For many years a prominent civil engineer in the west; engaged in the construction and management of important irrigation works; the owner and cultivator of an irrigated farm; the Surveyor General of the State of which he is now the governor, he brings to the discussion of this question a thorough knowledge of both the technical and financial problems of canal building; of the evils of the public land system and of practical irrigation from the standpoint of the farmer. We believe his recommendations are entitled to and will receive the thoughtful consideration of all who are interested in this question.

In the State Legislatures. The State Legislatures have convened in all the western states. The old governors have submitted their annual messages and the governors recently elected have made their inaugural addresses. In nearly all of these messages the importance of irrigation has been recognized and if some of the suggestions are adopted, it will show a good result as the winter's work. With its usual enthusiasm Kansas has introduced a bill in the House of Representatives, to place the occupants of the penitentiary at work reclaiming the far western portion of the state by building irrigation canals and ditches. Of course no one seriously anticipates the passing of the bill at this time, but it will not be long before the convict contract system will be abolished and then something of this kind may be hoped for. Already bills have been introduced into the legislatures of other states and as soon as the routine of committee appointments is finished some active work may be expected. Utah wants a state engineer; Nebraska is trying to adopt a revision of its irrigation district law; Colorado requires the regulation of water already appropriated; Idaho is seeking some means of protecting capital invested in irrigation enterprises and Texas is working on a similar plan; California is deep in the intricacies of the numerous phases of irrigation applicable to that state, and so on throughout the list. Even Minnesota has taken up irrigation and a bill is



A BOULEVARD, ONTARIO, OREGON.

under consideration and will probably be presented at this session.

A State Engineer for Utah.

The establishment of the office of State Engineer is advocated in the message of Governor Heber M. Wells, of Utah. The necessity of the State supervising the building of dams is self-evident and there can be no question that such an official should be vested with power to inspect, approve or condemn all engineering works, whether they relate exclusively to irrigation or to other industries. From an irrigation standpoint the office of State Engineer is of the utmost importance and within reasonable limits, the power conferred upon him, should be extended until it covers the appropriation of water as well as the erection of dams. Utah is to be congratulated upon the stand taken by Governor Wells and the legislature cannot do better than provide for the appointment as early as possible.

F. D. Coburn for Secretary of Agriculture.

At its regular annual meeting in Topeka, Jan. 15, the State Board of Agriculture of Kansas unanimously passed a resolution endorsing Secretary F. D. Coburn for Secretary of Agriculture in the McKinley Cabinet. This is one of the most sensible suggestions yet made. The Secretary of the Kansas Board of Agriculture is thoroughly familiar with the necessities of the practical (as different from the political) farmer. Under his able administration the work of the Board of Agriculture has been modified and extended until it has become of the most practical usefulness to the every-day farmer. The bulletins and reports issued have been confined exclusively to practical and interesting topics and have not been devoted to mere theorizing, and Secretary Coburn is a man of wide experience and liberal views, and he would render valuable service if chosen to preside over the Agricultural Department at Washington. It requires a man of Mr. Coburn's ability to make the Department what it was originally intended for, and not as it is at present, a laughing stock of the country.

Some States Omitted from the National Committee.

A careful examination of the list of the executive committee appointed at the last congress fails to reveal any members from the states of Wyoming, Oregon or So. Dakota. All of these states are identified with irrigation, and two of them, Wyoming and So. Dakota particularly so. It can truthfully be said of Wyoming that it has in force the most efficient and satisfactory laws relating to irrigation of any arid state. Not being as old in irrigation experience as Utah, or California, or Colorado, it was enabled to benefit by the knowledge they gained through years of trial. It stands to day as one of the leading states in its wise regulation of the appropriation and use of water and in its efforts to promote real irrigation development. South Dakota has become prominent of late by developing the artesian water supply for irrigation purposes and by the interest manifested in the subject in general. Certainly states so vitally interested in this important matter cannot be left off the national executive committee without being detrimental to the welfare of the movement, and it is hoped and expected that something will be done immediately to fill the vacancies mentioned.

Opportunities in the West.

The development of the resources of the mighty west proceeds along every avenue of human industry. Agriculture, manufacture, commerce are the leaders. It is along these lines that progress must first be made.

THE IRRIGATION AGE wants to assist each and all of them to an even greater extent than it has been doing. It wants to place before the homeseeker, the manufacturer, the capitalist and the merchant all the facts as to the opportunities for the profitable employment of their labor or money in the Great West. With this purpose in view it asks for information—brief, reliable and specific—regarding such opportunities. This information will be placed on file in THE AGE office for the benefit of inquirers and much of it will appear from time to time in the columns of the magazine. THE IRRIGATION AGE is the advocate of

every good enterprise tending to develop the arid Empire, and during the coming year it wishes to exert even greater influence in this direction than ever. In order to do this it must have the assistance of every friend of irrigation and the West. It asks for *your* hearty and active co-operation.

Industries Seek- A number of letters have **ing a Change.** come to THE AGE office recently asking for information as to locations for industries. A woolen mill and a cotton factory are seeking a change. Have you any inducements to offer them? THE AGE would be glad to bring together good locations and good industrial enterprises, and it offers its services for nothing. It is not expected that THE IRRIGATION AGE will do more than introduce the parties, but if it does that much it will have accomplished a great deal. Do not neglect to write, outlining what you have to offer such industrial enterprises.

Information for In the work which The **Homeseekers** Homeseekers Association **Wanted.** tion is doing is presented an opportunity too important to be overlooked or neglected by the friends of irrigation. The principal work of this association is the furnishing of reliable information to homeseekers but it must not be forgotten that before this information can be given it must be gathered and the Association welcomes from every source, facts, statistics and general information, reserving the right to investigate before endorsing or publishing the matter thus sent in. It is this aspect that should and will appeal strongly to the readers of THE AGE. They have an opportunity of disseminating through the medium of the Homeseekers Association a vast and most val-

uable mass of information relating to irrigation its benefits and possibilities; what it has done, is doing and can do. The possibilities of the small irrigated farm should be set forth clearly and concisely. Nothing is more convincing as to what can be done than to show what has been done. The actual experience of a practical irrigator giving name and location the area cultivated, the crops grown and the general results is a more forceful argument than a whole library of theory and governmental statistics to the average homeseeker. If you want good neighbors and plenty of them let the Homeseekers Association know what you have done.

**The Proposed
Agricultural
Exhibit.**

There is still another feature of the Homeseekers Association work which should be turned to advantage by THE AGE readers. It is the proposed permanent public exhibit of agricultural products. In this exhibit will be represented nearly every state in the union, but above all others the Empire of Irrigation should be adequately represented. Such an opportunity of placing side by side the orange of California and the wheat of Dakota for the inspection of the homeseeker and settler has not been presented since the World's Fair. The only conditions of this exhibit are that it shall arrive at the office of the Homeseekers Association free of expense to the Association, and be of such a nature that it will not entail any unusual expense or care in preserving it. The Association donates the space for the exhibit free of charge. The friends of irrigation have a splendid opportunity of demonstrating its benefits and practicability. Now is the time to act before all the space is engaged.



THE ART OF IRRIGATION.

CHAPTER XIX. THE AMOUNT OF WATER REQUIRED.

(Continued)

BY T. S. VAN DYKE.

A patient audience is often a great curse to a speaker for the art of talking without getting anywhere is rapidly cultivated. It is much the same with a writer and this is the hardest of all the hard subjects I ever undertook to explain. It is quite easy to say how much water is *not* required, but to say how much *is* required is quite another thing.

Suppose the irrigator orders thirty inches, two day's run, six times a year. These orders make three hundred and sixty twenty-four-hour inches, or practically an inch for a year. This would cover ten acres about a foot and a half deep, making one and a half acre feet, or eighteen acre inches. Suppose we allow the great amount of twenty per cent for waste and a little for error, we then have about fourteen inches going into the ground. This will be fully equal to twenty-eight inches of rain as it generally falls in the growing season. Much of it then comes in heavy dashes with a high percentage of run off and considerable in light showers followed at once by warm, bright sun. An inch of rain will wet ground in good condition about ten inches. As many rains do not exceed an inch a considerable portion of such is lost by evaporation and none of it reaches most of the roots of trees unless quickly followed by more.

The question then is how much of a crop will twenty-eight inches of rain produce?

Here we are met with many questions, but two are enough. What kind of crops do you mean and how large a crop do you want? Do you call four, six or eight tons of alfalfa a crop? Then the question comes how much of that success is due to something beside water? For it is certain that for very large crops of anything several things beside water are needed. And so we are all at sea again.

It is certain that government reports and many private reports are sadly astray about the quantity of water required to produce a good crop. Twenty-four inches

is about the figure reached by government experts, agricultural colleges and other observers, but most all the data come from rainy countries and too much reliance on general averages seems unavoidable. The following statements will therefore seem a trifle strong even to those used to California statements, in which we rarely bother ourselves about a cipher or two, provided always they are duly kept to the left of the decimal point. But as there is no state where so many rain records are kept over such small areas and people are so interested in the amount that falls California affords the best field for study of this subject. These statements are true, not for a few places but for thousands, and can be verified in every county south of Tehachapi.

GOOD CROP WITH LITTLE WATER.

Time and again eighteen bushels of wheat and thirty bushels of barley to the acre have been grown on a rainfall of twelve inches. In 1893 a piece of eight acres in San Marcos, San Diego county, yielded sixty bushels of barley on a rainfall of thirteen and a half inches and the next year, a very dry one with distribution anything but good, the same eight acres yielded fifteen bushels of wheat to the acre. These figures are from the books of the threshing machine and show the number of bushels for which the machine received pay. Taking the weight of the crop and straw this gives about four times the yield generally estimated as possible for that amount of water. Yet the rain was all the wetting it ever received.

Two tons of hay to the acre made of wheat or barley cut in the milk, the best hay in the world where it can be cured in dry air without any danger of rain, are the commonest kind of a crop on this rainfall and if the ground has been summer fallowed the preceding year so as to hold the moisture of that winter and catch the first rains of the year it is planted, on a face well open to receive

them, three tons of such hay are almost as certain as any crop in the world.

If allowed to grow into grain the stand would make about such crops as those on San Marcos.

Where the winter rains reach twenty inches, crops of corn of thirty-five to fifty bushels to the acre without a particle of water from any source after the planting of the seed are a common sight on the good uplands, while potatoes, peanuts and all manner of garden truck, with crops of pumpkins and squashes quite paralyzing to a tenderfoot, and other stuff too numerous to mention, may be seen in thousands of places, and this is not done by moisture rising from any sheet water below or on fog or moisture in the air, though cool, cloudy weather for a period in the spring materially helps the filling of grain. It is done entirely by the moisture in the ground retained by cultivation until the roots take it out.

These instances cannot be used as guides for all parts of the United States. The soil of the greater part of California has a great power of retaining moisture, especially the adobes, and a porous subsoil very deep and holding water with a wonderful grip is all but universal beneath the arable lands of the state. But I am certain that I have seen as large crops raised in Minnesota, Wisconsin and Illinois on the same amount of rain where the distribution was good, the crops well put in, and the weather good for ripening up the grain, but in many other sections that I have seen that are underlaid by rock floor, or where the soil is too "leachy" and will not hold moisture up to the surface under cultivation, or where the subsoil is too gravelly and will not retain the moisture long enough, it cannot be done. But the cases given to prove that the amount of water needed under certain conditions which are very common is much less than is calculated by officials from the ordinary data taken from large areas where all carelessness and waste are counted against what is the real wealth of the country.

On the other hand they do not prove that it may not pay to use for some crops double or triple the quantity. The quantity needed for a fine crop of apples is no test of the requirements of a fine

crop of oranges, or lemons, nor is the amount that will produce a good crop of grain any criterion of the amount it will pay to use if you want to work an alfalfa patch to its fullest capacity. But the fact that the duty of water is overestimated for so many things leads us to suspect that it may be for all.

SPECIFIC INFORMATION.

While the following figures are far from perfect they are probably the best attainable for I have compared notes with many of the best irrigators who have traveled much and studied the subject extensively. They are pretty safe for all those sections of the union where the soil is not too open, or the climate unusually hot and dry for a long time. In plenty of places less water will suffice. These are the amounts delivered on the land during the year and not the rate at which the water is used during the irrigating season. They are also in addition to the rainfall and represent average years, they mean also good work, wetting the whole ground and following it up with good and continuous cultivation for such things as can be cultivated.

FRUITS.

Under an average rainfall of twenty inches, for deciduous fruits of all kinds, from six to twelve acre inches. On this rainfall many do not irrigate at all yet raise profitable crops. But with very few exceptions the profits for any year except the very wet ones will be doubled and often tripled where the trees are very old and heavily loaded, and the certainty of the crop for the next year will be almost assured by one or two irrigations after the fruit is taken off. The best results are obtained with the larger quantity of water and I have never yet seen anything damaged by a foot and a half for old trees if properly used. Nevertheless the average seems about nine inches in depth.

For oranges and lemons in full bearing from one to three acre feet, the average is about two. One foot is rarely enough for old orange trees in full bearing and will never give the same profits that three will if carefully used. The wide difference is explained in the preceding chapters. The growers of the

best fruit use three feet if they can get it.

FIELD AND GARDEN CROPS.

For corn and most garden stuff six to twelve acre inches, but on twenty inches of rain more of these are raised without water than with it. But the rule is the same as for deciduous fruits above mentioned and may be taken without exception for almost anything that whatever you can do without irrigation you can far surpass with it.

On this rainfall grain is not irrigated at all except in a very few places and there six acre inches seem the greatest amount used.

For alfalfa in small patches for home use one to two acre feet. In large fields to get a series of heavy crops from three to five acre feet.

Where the rainfall is only ten inches these amounts are increased about twenty per cent. except for alfalfa. Strawberries and many such things need water *at a rate* much in excess of this, and so does a lawn if sprinkled, but not if flooded, but no one keeps any account of the amount used for berries, lawns etc., and at the water company's office the books show only what is taken for the whole place.

The larger figures above given represent much waste. Except on very porous soil or a very hot and dry locality the average of the two sets of figures is enough. On many soils where the air is not too hot and dry the smaller figures are enough for almost anything but heavy crops of alfalfa, oranges, lemons or berries, provided the water is carefully used and good cultivation kept up. The whole subject is full of qualifications that make conclusions taken from one place almost worthless for the next. For instance there is much alfalfa land that is naturally moist and still more so open that the roots will reach standing water below. This will give very good crops without any irrigation if the gophers are drowned out regularly. A six inch flooding twice a year will generally do this and a nine inch one is quite sure to. Much of this moist land is so easily kept free of gophers that one six inch flooding a year will do, but many will put five feet of water on such a soil because they have it, the soil is so open that it

drains away beneath leaving apparently no bad results. The yield under such watering is very heavy but it is certain that no such amount of water is needed on that kind of ground.

A RAINFALL OF TEN INCHES.

In the few parts of Southern California where the rainfall is below ten inches there is little, if any, more water used than where it is ten. Where it is practically nothing, as on the Mojave and Colorado deserts, there is no settlement from which any reliable data can be had. But from experiments I have made in a few places with the soil there, from the irrigation on the few places there are, from the results of overflow in some years and unusual rain fall at others, there is the best of reason to believe that if the ground were once well filled with water and the subsoil kept full by winter irrigation (that is put in the same condition it would be in on the western slope after good winters) it would not require for the hottest and driest parts, having the longest spells of hot weather more than thirty per cent. more summer water than on the western side of the mountains. And on all that portion which lies 2,000 feet or more above the sea, like much of the western side of the great plains of the Mojave, it would not require any more water than the average of the country on the Pacific Slope. I believe this principle will apply to most all the desert sections of the Union. The loss from the top soil by the hotter sun of some of the hottest parts amounts to almost nothing if the soil is well cultivated. The loss by the transpiration from the leaves during the hotter and longer weather is about all that need be considered. For late fruits this amounts to something but is not so much in excess of what it is in the cooler countries as one would imagine. Neither is the difference in the dryness of the air of half as much consequence as one would suppose. Thirty per cent. more water will balance these anywhere if the other points are attended to. The land that in Arizona, New Mexico, Utah, Texas, Nevada and other states now looks so thirsty that a young river would hardly seem enough to give drink to a farm, really needs but little more summer

water that any other sections if started off, in the spring with the ground in the same condition as that of the countries having plenty of rain or snow in winter. If this were not so the development of the arid west for many years to come would be about closed.

It is very difficult to approximate the duty of water when used in basins. Hardly any one knows the size of the basins, the amount of water he puts in at a time, or how many times a year they are filled. So irregular is even the same person with this work that I have found it almost impossible to gauge it. I have seen much of it and done considerable myself but it is rarely done twice just alike. Most all this work is done with windmills or some sort of limited supply where it is very difficult to measure the water and none attempt it. There are but two companies that I know of anywhere under which the basins are used to any extent that make the records of the water officers of any value. Under one of these the basins are so large as almost to approach flooding. One can here get so large a head of water that very large basins can be filled two or three times the same day on ten acres. I find the amount used is about an acre foot during the summer, but the rain fall is here about twenty-two inches.

At another place the pipes are so small and the water supply so limited that a six-inch head for twelve hours or a twelve-inch head for six hours is about the best the most accomodating ditch tender can do for you. The amount used here is about half an acre foot also used during the summer, this with a rainfall of about twenty inches.

Where the rainfall much exceeds twenty inches, no reliable data are available as it is mainly in the mountains or foothill canyons where the irrigation is of the crudest and most wasteful kind. Outside of San Diego county, California, I do not know of the basin system being used on a rainfall much less than twenty inches, there it is used in some places

where the precipitation is as low as five with a maximum of about fifteen, running one to twenty-six, but with an average of about nine. Where nothing better can be done this certainly pays where one does one's own work and attends closely to it.

You will remember that an inch under four inch pressure runs about 4,750,000 gallons a year. With 1,000 trees on ten acres, 1,000 gallons a year to a tree would require 1,000,000 gallons. This would be an inch to about forty-seven acres, or about three and one half acre inches. This would give each tree 200 gallons (or about six barrels as they are filled) at a time five times a year. It is certain that some orchards that pay over \$100 an acre do not get more than this. There are places where this is doubled but they are the exception. They cannot use much more than an inch to forty acres because they do not have it. While the duty of a windmill is hard to ascertain it is not hard to draw the line it cannot exceed. As before stated this style of work is bad where it is possible to do anything better. But it certainly does pay in many places. And for a large portion of the United States where the rainfall is just a trifle short or too irregular, and where the nature of the product will not justify more expensive systems, such irrigation may mean the difference between a prosperous country and a cattle range. For to make a country prosperous it by no means follows that even the greater part needs irrigation. Give a man one hundred and sixty acres of many kinds of land and you do him an injury. You might better give him a piece of desert and clean him out with neatness and dispatch so that he will have some time and money to go somewhere else. Much of the semi-desert will do the same, but use up his life and money, but if he can irrigate twenty, or even ten acres of it he may stay and prosper, working the rest on the rain when it comes; and five, and even two acres, well watered, will often enable him to do the same.



THE INFLUENCE OF FORESTS ON IRRIGATION.

BY B. E. FERNOW.*

There has been considerable wild discussion on the influence which forests are supposed to exercise on climate, waterflow and other conditions. On the one hand enthusiastic forestry advocates, who clamor for forest preservation—in itself a misleading term—have claimed extravagantly and unconditionally such influences, on the other hand, men who ought to have had enough scientific training to know better, have as unconditionally and extravagantly denied such influences. The one position is as unphilosophical as the other. Every student of nature, be he only an observer of it in the field, or be he only a reader of what has been written by observers, knows that all things are in relation, that, therefore, we cannot take away anything from the complex conditions of nature, without affecting more or less all other conditions. The question then can only be as to character, degree and extent of the influence of one condition, or its change and removal on other conditions, and that this depends necessarily also on the character, degree and extent of the changeable condition is self-evident.

In other words, the question as to whether the removal or devastation, or the continuance and proper treatment of a forest has a practical influence on climate, soil or waterflow cannot be discussed in general terms, but its solution must be dependent upon the character,

extent, location and specific conditions of the forest cover in each case.

It stands to reason that the dense tall forest growth of evergreens of the northern Sierra Nevada must exercise a very different degree of influence on its surroundings, than the open, stunted, shrubby growth of acacia and mesquite around Phoenix or the beautiful, park-like, pine forest of the Colorado plateau, or the scanty growth of juniper and pinion that covers so much of our drier mountain slopes. Each of them has its influence on surroundings, but the degree must differ according to their constitution and location and finally it may be practically of no value.

The requisites of satisfactory water supply in irrigation, I take it, besides the quality of the water, its availability for irrigating purposes are: sufficient quantity, equable flow, absence of debris and silting in the channels.

In all these directions a forest cover may exercise beneficial influence.

Whether a forest area may increase the total amount of rainfall over its own or an adjoining area is still an open question, which will not be settled until we have better means of measuring rain: for as is well known our rain gauges are but poor means for the purpose for which they are intended.

Nevertheless the forest may have an influence upon the amounts that remain available of what has fallen. In the

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first place, tree growth transpires as a rule much less water than the annual vegetation, or more than would be evaporated by sun and wind if the ground was not shaded. The shade and the mere wind breaking quality of a forest growth—the velocity of the winds increasing their evaporative power in acceleration ratio—preserves a large amount of moisture and especially where the supply is dependent on winter snows the effect is most noticeable in preventing the rapid wasting by evaporation.

In the second place, the forest floor, if in good condition and even without that, the deep reaching root system of the trees keep the soil in a granular, open condition, which allows the water to penetrate, while in the open barren the soil is compacted until the rain must run off superficially, having no chance to enter the ground. That soil conditions and geological structure must also have a potent influence in this respect stands to reason. The loose sand, no matter whether forest covered or not, will remain permeable, while compact clay soils, even though forest covered, will still resist the passage of water to a degree. The penetrability of the soil under forest cover induce subsoil drainage instead of surface drainage, or at least a longer time is given for the former, before the latter begins.

This is especially important when the snow melt begins in spring; in the unfrozen penetrable forest soil the melt water has to percolate, while over the usually frozen and compact denuded soil the water rushes off superficially and makes or aggravates the spring floods.

This same permeability of the ground together with the mechanical obstruction which the tree trunks and the shrubbery of a well kept forest offer, and by which the surface drainage is decreased in amount and changed into sub-drainage, also prevents the washing of the soil, the gullyng and the carrying of silt and debris into the water channels. Again I recall that the degree of this must depend on the character, condition and location of the forest cover; it may become nil if the forest floor has been repeatedly burned, has been trampled by cattle and sheep and the trees have been mostly removed,

thereby reducing forest conditions.

That these things are so modified to be sure according to local conditions, is not any more a fancy, a guess, a supposition, for the experience in France during the last 100 and especially during the last 30 years have proved them, if we did not have sufficient proof in our own country over the hill lands of Mississippi, and in fact more or less in all parts of the country. In France the deforestation or devastation of about 8,000,000 acres of mountain forest has resulted in a devastation of 1,000,000 acres of agricultural soil in the plain below by the sudden changes in water stages and the torrential action of the rivers, the silting over of grounds as far as 200 miles away from the source of the evil.

Again the government having spent over \$12,000,000 and the impoverished communities about as much to reforest some parts—it will take three times as much to remedy the evil—the experience has been gained that this kind of a cover, forest cover, will do what is expected of it and reduce the wild action of the waters and prevent the silting of the channels. While these experiences have been had without reference to irrigation problems it is evident that they have a bearing on the same, if equable flow, instead of repeated floods and unobstructed channels for carrying the waters to reservoirs, etc., are desirable.

Irrigationists then should be interested not in the preservation, but in the proper use and conservative management of the forest cover at the headwaters and along the water courses, so as to secure the most favorable conditions of water flow, for without forest management no rational water management can be maintained for any length of time. There are, to be sure, irrigation districts where natural forest conditions are if not absent such as to assist but little in the directions mentioned. Yet even there that little helps and would be a matter of prudent management to improve those conditions rather than to leave them to further deterioration.

I have laid particular stress upon the difference between forest preservation and forest management.

Forest preservation would imply that a protection forest could not at the same time be used as a supply forest; in other words that to secure the protection which the forest cover offers to soil and water conditions we must abstain from using the material grown in the forest.

This is by no means necessary, but the use of that material must be subordinate to the protective function expected from the forest cover and the utilization must be carried on with care so as to secure reproduction, not in the style of the lumberman, who simply takes the cream and leaves the rest to fire and destruction, not caring for the condition and its future.

The president of the United States has the right of law to set aside from

the public domain, forest reservations for the purpose of securing favorable conditions at the headwaters of streams. In spite of strenuous opposition by lumbermen, sheep-herders and miners, some 17,000,000 acres have been so reserved. But in the absence of proper means of administering these it has seemed best not to increase this reserve until legislation is secured which will enable the proper protection and use of the same.

If the irrigationists conceive their interests on broad lines, they will insist upon the passage of such legislation and an extension of the policy of forest reservations to include all such forest areas as are situated at the headwaters and along water courses, which may become means of irrigation.

NONTANA AS AN OBJECT LESSON.

BY GEORGE H. SCOTT.

Traveling Staff Correspondent Rocky Mountain Husbandman,
White Sulphur Springs, Montana.

THE development of arid lands to the stage to which their resources and the needs of future generations should ultimately carry their progress, will embrace the solution of many interesting problems, and witness the unfolding of far-reaching effects. Among the many and important engineering problems will be the diversion of great streams, the recovery of vast quantities of preatic water, the construction of myriads of canals, lakes, dams, aqueducts, tunnels and reservoirs. And before the happy consummation of this period there will surely be the most significant questions to be answered as to the most economical and effective application of the power to be used, which will be wind, steam, water and electricity, especially the last.

Let the careful observer for just a few moments, contemplate what all this would signify and mean to this and coming generations if the whole region denominated the Great Plains, could be completely submerged by systems of water supply sufficient for their reasonable and thorough irrigation. Such an

elevated degree of development of agriculture and horticulture as it would certainly bring about and then an increased urban and manufacturing class of people as never was before known since the creation, would follow. It would establish a new era in the progress of all lines of industrial improvements. The progress along all lines, the wealth, the added comforts, the superior educational opportunities, social and economic advantages arising from such density of population may very easily be imagined without the aid of the Roentgen rays being thrown upon the new movements of common humanity. The readiness and ease of transportation by public highways, by rail, and by artificial waterways; their great productiveness, their inland situation, their healthfulness, their safety from foreign invasion, from floods and from tornadoes, would render them at once the chosen homelof those who seek health and security, and make them the granary and the citadel of the continent.

Since the principal support of human-

ity comes from Mother Earth, all that may augment or facilitate the products of the soil is of primary importance to the agriculturist and horticulturist alike, for they are sister industries, and statistics from along this line prove beyond a doubt that the vigilant irrigation of lands, where artificial application of the aqueous fluid, is necessary, increases its productiveness from two to ten-fold, and this has a decided tendency to increase a country's population in about the same proportion.

population is sufficiently dense to afford a large attendance from their immediate locality. And it is also a remarkable fact, that advanced learning in the United States, has drawn a very large proportion of its most illustrious exemplars from those who were bred upon the farm.

There are, I believe, four very, very important elements without which the common genus homo, cannot live—the rays of old Sol, oxygen, aqua, and this mundane sphere. There should not be,



A CABBAGE FIELD IN WESTERN KANSAS,

The science, (for science it is, and not a scheme) of irrigation has a tendency to increase the density of population upon the farm. It also has a most pronounced effect on the growth of cities, towns and villages. Plain figures show that in modern times one farmer is taken as the basis of support, of from two to seven persons engaged in the other occupations pursued by the urbanites.

It is a well-known axiom that the high school, seminary, college and university can only be most efficient when

there cannot be, in the name of humanity, any monopoly of these elements so essential to man's existence, and at the present time, I think, there is no other question—not even the silver-question—that begins to equal in importance the question of the development of the arid and semi-arid lands of the United States of America.

It is very well understood by every citizen that these arid lands belong to the American people, for they are a grand heritage from the United States. In

Montana alone there are over 30,000,000 acres of agricultural lands composed principally of fertile valleys, lying so that with enough capital they may all be placed under irrigation ditches and reservoirs of water, that will be to the broad acres of these arid lands a source of fruitful fertilization. Some people have been led to believe that only the Government is capable of bringing the arid lands under the influence and magic touch of water, but there is quite enough and to spare of idle capital in America today, if invested in these enterprises to accomplish untold good to suffering humanity—suffering quite as much for something to do as for something to live upon. And this happy state will soon be realized, for the horizon is already aglow with the results of the investment of timid capital in these enterprises.

There is at the present an idea on foot to gather the headwaters of the Missouri river and utilize them for irrigating purposes. The Government has not offered to do this for us as yet, but it will be accomplished in part in time without their aid. At Canyon Ferry, some eighteen miles from Helena, an objective point on the Missouri river, a vast water power is being created by eastern capitalistic enterprise. The great river has recently been spanned by a dam thirty feet high to secure electric power, a small portion of which will be used in the Capitol city for lights, power for the electric car system and East Helena smelters. But that is not all, for the company will utilize the balance—9,000 horse-power—to develop the numerous resources contiguous to the plant. One of these is the furthering of the rapidly growing industry of agriculture, and it will be able to handle some of the billions of cubic feet of water going to waste annually, applying it to the desert which will respond at once to its revivifying influence.

There is a certain greatness about the Montana valley, and they would all be fruitful with irrigation, for the whole state is well supplied with rivers of large

volume and mountain streams in great profusion; but however productive it might be without irrigation, it is certainly vastly more so with it. This fact has been well recognized since the earliest settlers in the early '60s in the Gallatin valley sowed the first wheat and oats raised in the territory near the banks of the Gallatin river from which they turned water into their growing fields. In many sections of Montana today there is a thorough system of irrigation. Millions of dollars have been invested in canals, and more attention is paid every year to that important branch of agriculture. The smaller valleys are cut through and through with canals from which branch smaller ditches that spread out over nearly every section of the tillable land near the small streams. The most progressive section of the state along this line is to be found in the Yellowstone valley, near Billings. At this point, in Clark's Fork Bottom some forty miles in length there are 180 miles of irrigating ditches carrying from 1,000 to 20,000 inches of water. There and in Gallatin valley is to be found existing the most thorough system of irrigation to be found in the whole state, the Bitter Root, Teton, Madison, Missouri and Smith River come next in this enterprise. And it is in these valleys that the progressive farmers are paying the most attention to diversified farming. They do not depend entirely on grain as a crop, as was the case several years ago. More garden produce is being raised from year to year. Montana vegetables cannot be excelled anywhere. The farmers are paying some attention to hog raising, dairying, etc., instead of depending upon the range entirely for a certain part of their annual revenue. The mines may give out, smelters close down, and stock of all kinds perish by the tens of thousands on the range, but Montana, in the future as in the past, may be depended on to raise wonderful crops of cereals, vegetables and fruits—enough to supply ten times its present population.

THE WIND-MILL IN IRRIGATION.

BY W. C. FITZSIMMONS.

WATER may be scarce in many places but wind is nearly always abundant everywhere and should be utilized more as a motive power in this country. Other countries are ahead of us in this respect. Holland has long been noted for the number of its wind-mills. With proper appliances, wind power is nearly always available and effective; it is also cheap. It is the part of wisdom for farmers and especially for irrigators to make use of the wind for raising water and doing odd jobs about the farm. A windy country is often an unpleasant one, but when this disagreeable climatic feature can be utilized in pumping water for irrigation or for stock, for grinding corn, for making butter and for a number of other necessary purposes on the farm, it may be easily endured if not enjoyed.

In the treeless and arid regions there is seldom any lack of wind and enormous possibilities in the way of wind power are continually neglected. But in these days when good wind-mills (we prefer the old-fashioned name, rather than "wind engines," "air motors," etc.) are to be had at comparatively small cost almost everywhere, much greater advantage should be taken of this ever-present, ever active force which is capable of doing wonders in the way of lightening the farm labors.

While we may be ready to accord to science and scientific achievement the highest encomiums in the realm of steam and electrical appliances for the generation and utilization of the mighty forces so controlled, yet the wind-mill of the most modern manufacture is not necessarily a more effective machine than those made in the years long gone by. It is very apt to a better looking affair, if indeed there can be such a thing as a line of beauty connected with a wind-mill, but it is doubtful if any of the *fin de siècle* air machines will pump more water or churn more butter than those of simpler type upon which that doughty knight, Don Quixote de la Mancha, charged so gallantly 100 years ago.

An up-to-date wind motor, as it is called, may cost \$150 and be well worth that sum to any farmer who buys it; but it is comparatively easy for a man with a little "gumption" to organize a home-made wind-mill that will surprise him and especially his neighbors by the amount of hard work it will do for him both by day and by night. The same breeze that fans the farmer's cheek grinds his corn and saws his firewood; and the gale that may scatter his fence rails also fills the water tank and irrigates the orchard. We are also nearing the time when all sorts of wind motors will be used to generate electrical power to be stored for use in heating and lighting country households and without a doubt to propel farm machinery and vehicles.

It is alleged that the New Jersey Insane Asylum is lighted by electricity generated from a dynamo moved by a wind-mill of the most simple construction and very moderate cost.

A farmer near Geyserville, Sonoma county, California, has a queer looking affair which, at a distance, looks like anything but what it really is—a wind-mill which does yeoman service in filling the water tank. The machine is of simple construction but is somewhat unique. A box without top and also open at the bottom, is made of upright boards 9 feet long, the inside dimensions of the box being 4 by 17 feet, and 9 feet in height. This is merely placed on the ground and across the top, mid-way of the length, is placed a shaft to which the arms carrying the sails are fastened. As the sails revolve, those above the box of course catch the force of the wind while those below, within the box, are protected so that the wheel is always in a condition of unstable equilibrium, hence moves on and on, under the force of even a slight breeze and does good work at the pump.

The main object in calling attention here to home-made appliances to utilize wind power is merely to point out to the man who would not or could not buy a complete machine of modern type composed largely or wholly of metal,

that he may provide himself mainly by his own labor with an effective machine of that kind. When the necessity of present economy is not too pressing however, it will be found generally best to buy the most approved types of modern wind-mills made largely of iron and steel. Such machines are very durable and while they may not be able to do more or better work than some types of home-made machines they give better satisfaction all around than anything which the farmer might himself make at a cost enough less to prove an incentive to undertake the task. The point sought to be urged is: Get a wind-mill. Get the best one possible; if able, get one made of steel or iron; if *not* of these then let it be of wood and of the best type. But if you cannot buy one of these don't go without a wind-mill. Make one.

A FARMER'S FISH POND.

BY R. HALDEMAN.

OUR fish pond is situated five and one-half miles northwest of Alda, Hall Co., Neb., in the Platte valley, between the Platte river and the Loup. It is 185 feet long and 90 feet wide, it has at present about four and one-half feet of water, although this can be increased to six feet. It is supplied by a common wind mill which stands about 125 feet from it. The pond and the mill are connected by an underground inch and a half pipe which comes up out of the ground just outside of the pond. This pipe has a waste joint where it is connected with the pumps, to keep it from freezing in the winter. We stocked our pond with German carp, which we received from the state fish commission at North Bend, Neb. Besides these we have a few catfish and some suckers. There are countless small fish which were hatched last summer. We feed our fish bran, bread and corn. We have used our pond as a reservoir, as well as a fish pond, irrigating a garden and a small truck patch, by means of a rubber hose, for two seasons. Although it was not necessary to irrigate, we have had better success with our garden by irrigating some through the dry weather than before we made the pond. Our

pond also makes a nice skating rink in the winter as well as a good place to get ice to put up for summer use. Our pond was made with a common road scraper. It took two men six days to make it. One man can use a scraper by himself, although it is better to have one man extra to load. In making our pond we first commenced at one corner and made a bank all around the embryo pond as high as the dirt from the first scraping would make it. The first scraping does not need to be plowed. We then plowed it as deep as we could with common plow. We then took the second scraping out, putting it entirely around the pond the same as before and keeping the bank as nearly level as possible, each scraping raising the bank about six inches, although this depends on the size of the pond. Each succeeding scraping is disposed of the same as the first and second, although the deeper you get the harder it is to plow and scrape, as the soil here is a kind of clay, after the black soil is taken off the top, which bakes in the sun and gets sticky and hard.

This clay, although hard to handle, is very good for a pond for it will hold water until it evaporates after it gets packed solid. When starting, the bank should be fifteen or twenty feet wide, this will, by constant tramping and rolling down of dirt, spread out to twenty or thirty feet, and if the back is to be more than four or five feet above the surface will need to be wider than this. Our pond is three feet deep below the surface, while the dirt taken out makes a bank about three and one-half feet high, making the pond about six and a half feet deep from the top of the bank. The more driving over the bank the better, as this tramps it and keeps it packed as it is added to. After the pond is done it will have to be puddled, which is done by letting five or six inches of water into it and then tramping with horses or harrowing and tramping it to make it solid in the bottom.

Our pond cost us six days work with a team and two men to make the pond. Three men one day to lay the pipe and twelve and one-half cents a foot for 125 feet of one and one-half inch pipe. Of course besides this the wind-mill is to be

partly considered, although we had the wind-mill before we thought of the pond, and it has done all the pumping for the stock as well as standing idle part of the time. Although we have not had our pond long enough to have fish large enough to use, yet I think it will pay anyone to make a small pond to irrigate, if for no other purpose, for then they are sure of a good garden every year.

ALFALFA EXPERIMENTS.

Bulletin No. 44 of the Utah Experiment Station reports the results of extended feeding experiments on (a) Yield and feeding value of early, medium, and late cuttings of alfalfa; (b) Yield and feeding value of the first, second and third crops; and (c) feeding value as compared with red clover, timothy, mixed hay, and alfalfa mixed with straw.

The trials (a) and (b) are thus summarized by the writer of the bulletin, A. A. Mills:

1. Steers, fed either the alfalfa with or without grain, made the most rapid gains on the early cut, and the lowest on the late cut, or they stand as follows: Early cut, 100; medium cut, 77; late cut, 68.

2. For both first and second crops, the early cut was first in rate of gain, while for the first crop, the late cut was better than the medium cut, and for the second crop, the medium cut is far the better of the two.

3. The food eaten per day was slightly the highest for the early cut and lowest for the late cut, standing as 100 for the early cut, 99 for the medium cut, and 85 for the late cut.

4. Pound for pound, the early cut was the best, the late cut, second best, and the medium cut poorest. They stand as 100 for the early cut; 78 for the medium cut, and 81 for the late cut.

5. The early cut yielded the most hay when weighed into the barn, the medium cut coming second and the late cut last.

6. The early cut contained the most moisture, and when all are reduced to the same moisture content, 12 per cent, which the hay contained when fed, the yield stands: Early cut, 100; medium cut, 93; late cut, 90.

7. In amount of beef produced per acre the standing is: Early cut 100; medium cut, 71; and late cut, 71.

8. In yield of protein, a very valuable nutrient, the standing is: Early cut, 100; medium cut, 78, and late cut, 82.

9. During the two weeks of budding and flowering there appears to be no additional growth; in fact our results show a loss of 82 lbs. per acre of dry matter during this period.

HOW FARMERS LIVE IN CUBA.

IF it be the government dictated by Spain, that makes possible the conditions in Cuba depicted by Mr. J. Knapp Reeve, one can easily understand the fighting humor in which the Cubans are. But if it be the home government that is chargeable with all or any part of the horrors of rural life on that sunny island we cannot conceive a man insane enough to raise his hand to save such a government from going straight to the devil. Mr. Reeve says: "Between the condition of the planter and that of all other agriculturists whatever in Cuba the widest difference exists. The laborer has nothing, never has had anything, and is happy in the knowledge that he never will have anything. The small farmer, the owner of a few acres, is the most abjectly poverty-stricken son of the soil that I have ever met. He lives in the poorest habitation known to civilized men, a hut made of the bark of the palm tree. Beside it the adobe dwelling of the Mexican is a palace. It has one room, a dirt floor, neither window nor chimney. In this the family live like cattle, subsisting upon the poorest of food, as most that the soil produces must go to pay the taxes. Children run about, guiltless of the knowledge of clothes until six or eight years old. Books, education, the world, are things of which they have never even dreamed."

Professor Troop, of Perdue University, Indiana, gives the following as a remedy against apple tree lice (aphis.)

KEROSENE EMULSION.

"This is made by dissolving one-half pound of hard soap in one gallon of hot water, after which add one gallon of kerosene or coaloil and mix thoroughly, by forcing the mixture back into the same vessel by means of a spraying

pump, until it becomes a thick creamy mass. Dilute this with ten times its bulk of water before applying it to the trees."

Besides producing annually almost an ocean of wine, the people of France also make large quantities of cider. In 1892, the French vintage amounted to 639,804,000 gallons of wine of the various classes, while the cider output of that year is given by *Le Cidre* of Paris at 333,109,000 gallons. In 1893 the vintage reached the enormous quantity of 1,101,540,000 gallons, or about thirty-six times the amount produced the same year in the United States.

TEXAS.

The wheat crop of the Wichita Valley, Texas is reported in fine condition for a large crop the next season. That part of the state has recently been visited by abundant rains and farmers are much encouraged over the lookout.

The valley has become famous as the center of the wheat belt of Texas, but being too far west for a dependence on rainfall with much certainty, its enterprising citizens have succeeded in interesting capitalists to install an irrigation plant, which, in its greatness of conception, will at once attract the attention of all who delight to see the Great West brought forth from its state of aridity.

The reservoir to be constructed on the Big Wichita river will be numbered among the largest in the world. We hope to be able, in the near future, to give our readers a complete account of the whole affair.

INTERESTING ITEMS.

Distilling sweet potatoes for alcohol and whisky is a new industry in the south.

The United States consumed last year more than 4,000,000 bunches of Jamaica bananas.

A man in South Carolina has about forty acres of land under cultivation devoted to tea plants. His shrubs are about three feet high and planted in rows six feet apart.

Foreign lemons are being shipped into New York and sold in such quantities that the California growers of lemons have abandoned the eastern market.

Over the 10,500 miles of railroad in Illinois last year there were carried 63,-

485,413 passengers with a loss of only twelve lives.

It requires 15,000,000 cows to supply the demand for milk in this country and the products of 60,000,000 acres of land to feed them.

The state farms in North Carolina where convicts are employed have 5,000 acres in corn and 4,000 acres in cotton.

There are more than 500,000 telephones in use in the United States and they are used more than 2,000,000 times daily.

Oregon has 25,000 acres of prune orchards.

BOOKS AND REPORTS.

During the past month *THE IRRIGATION AGE* has been favored with copies of the following books and reports, all substantially bound for preservation.

Tenth Biennial Report of the State Board of Agriculture of Kansas, including the state decennial census of 1895; edited by F. D. Coburn, Secretary, Topeka. Can be obtained by remitting 30 cents to cover postage.

Thirteenth Annual Report of Agricultural Experiment Station of the University of Wisconsin; Madison.

Report of the work of the Agricultural Experiment Station of California for the years 1894-1895; Berkeley.

Agriculture by Irrigation; Eleventh Census of the United States, New Edition prepared by F. H. Newell of the Geological Survey, Washington.

Manual of Irrigation Engineering, by Herbert M. Wilson, C. E. Second Edition Revised. Published by John Wiley & Sons., New York City.

Tables showing Loss of Head due to Friction of Water in Pipes. By Edmund B. Weston, C. E. Published by D. Van Nostrand & Co., New York City. Price \$1.50

Tenth Annual Report of the Commissioner of Labor on Strikes and Lockouts, Carroll D. Wright, Washington, D. C.

Eight Special Report of the Commissioner of Labor on the Housing of the Working People, Carroll D. Wright, Washington, D. C.

Production of Gold and Silver in the United States in 1895. R. E. Preston, Director of the Mint.

Eighteenth Annual Report of the State Board of Agriculture and the Agricultural College; including the Ninth Annual Report of the Experiment Station, Fort Collins, Colo.

A copy of the Ogden (Utah) Standard Annual has been received, and contains many illustrations of handsome business buildings and residences of the Gate City, together with information concerning the resources of Weber County, and Bear River Valley in particular, and the state in general. Persons interested in Utah should send for a copy. Price 5 cents.

SOUTH GILA DAM.

Mr. W. Crouch, member of the Institute of Civil Engineering, residing in Glasgow, and associated with some of the largest enterprises of Great Britain, was sent over some time ago to examine and make a report on the South Gila Company, who are building the enormous dam at Sentinel, Arizona. The report is interesting. That portion of it referring to the method of construction, reads as follows: "A Lidgerwood cableway is stretched across the canyon on which a trolley runs, and by it the stones are picked up and deposited wherever required on the work. This appliance is a very ingenious one, and has been very successfully used in the construction of similar work in the states, and for rapidity of handling material and depositing it on any part of the work, is, in the circumstances in question, undoubtedly superior to any system of railways or tramroads that could be devised." J. F. Ward was the chief engineer of the dam.

TEXAS COAST COUNTRY.

The Texas Coast country vies with California as a place to profitably raise pears, grapes, and strawberries. Six thousand dollars' worth of pears from thirteen acres has been produced there in one season, and can perhaps be duplicated by you. G. T. Nicholson, G. P. A. A. T. & S. F. Ry. Chicago, will be glad to furnish without charge, and illustrated pamphlet telling about Texas. Send to nearest agent for ticket rates. There is usually a low fare in effect to all important Texas points.

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Who wish to start over again in some locality where good land is plentiful and climate is favorable, should post themselves relative to the irrigated districts of Kansas, New Mexico and Arizona, the dirt-cheap farms of Oklahoma, and the fruit tracts in southern Texas.

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On the Gulf Coast two and three crops of vegetables are raised each year. Berries are shipped six weeks in advance of the home crop in the north. Pears, peaches, plums, oranges, figs, olives and nuts all grow abundantly and can be marketed from two to three weeks in advance of the California crops. Large quantities of rice are now grown.

If the land seeker, the home seeker and the settler desires to secure a farm larger than the one he occupies, on vastly more reasonable terms; if he wants more land to cultivate, a greater variety of crops to harvest, with proportionately increased remuneration, at a less outlay for cost of production; if he wants an earlier season with correspondingly higher prices; if he wants milder winters, all the year pasturage for his stock, improved health, increased bodily comforts and wealth and prosperity, he should go to Texas.

Send for pamphlet descriptive of the resources of this great state (mailed free). Low rate excursions via the Missouri, Kansas & Texas Railway every month. Address H. A. Cherrier, Northern Passenger Agent, 316 Marquette Building, Chicago.

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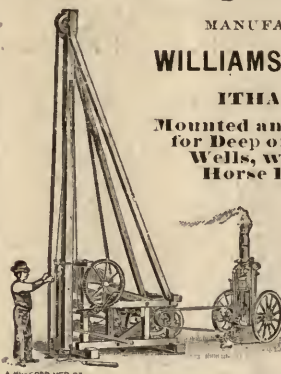
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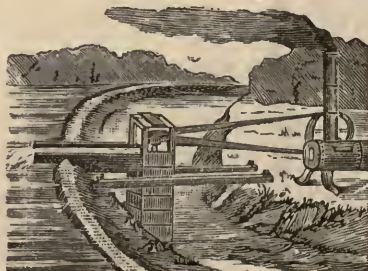
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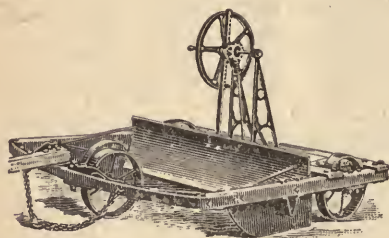
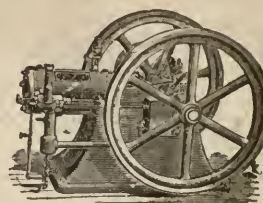
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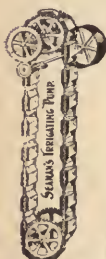
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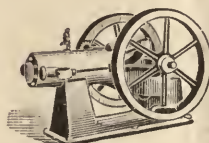
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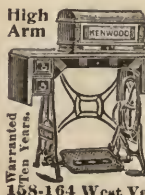
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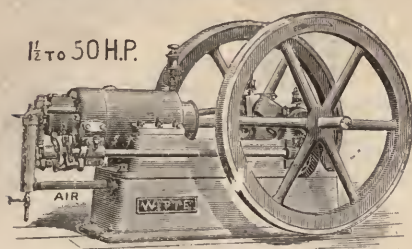
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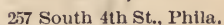
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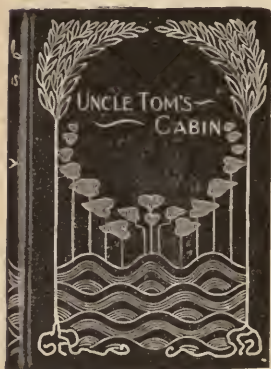
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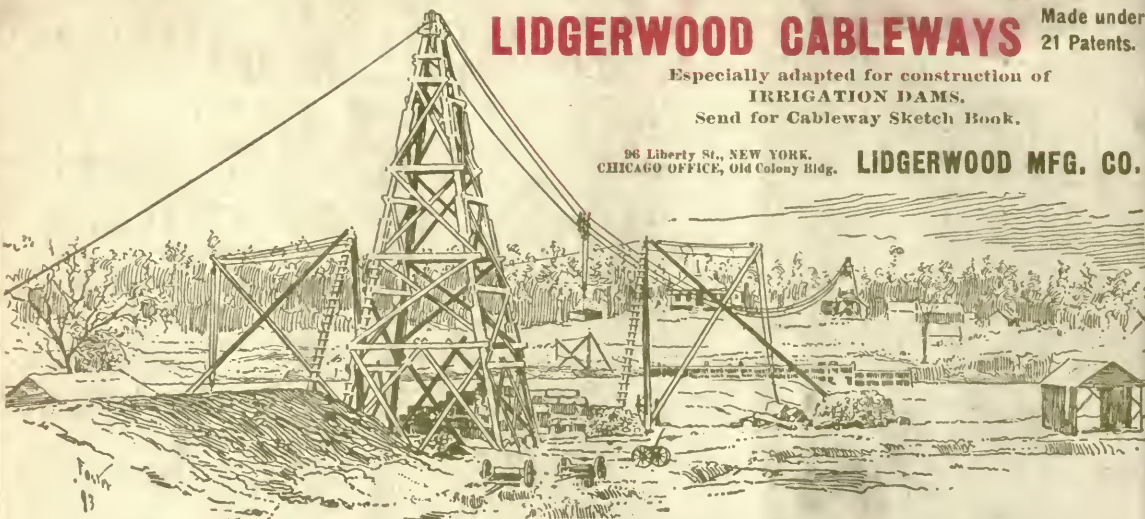
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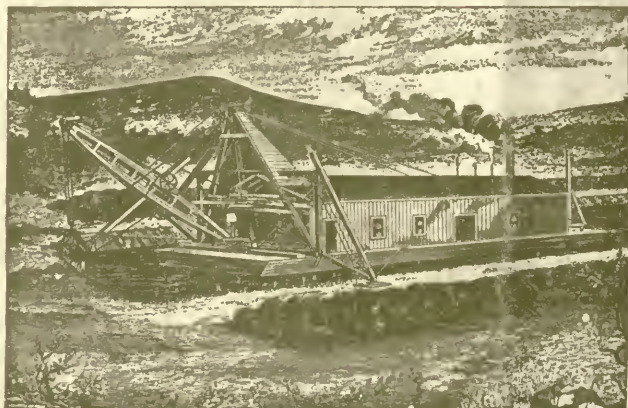
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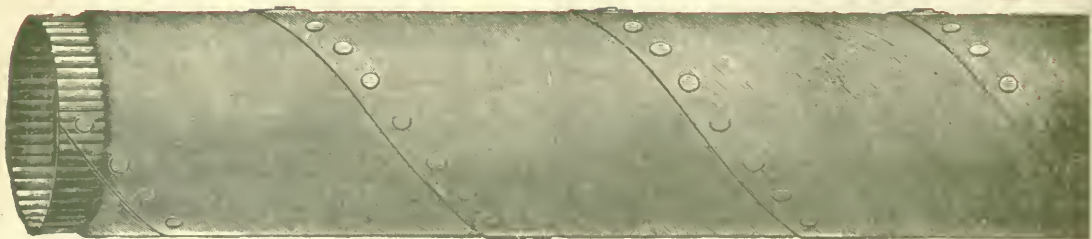
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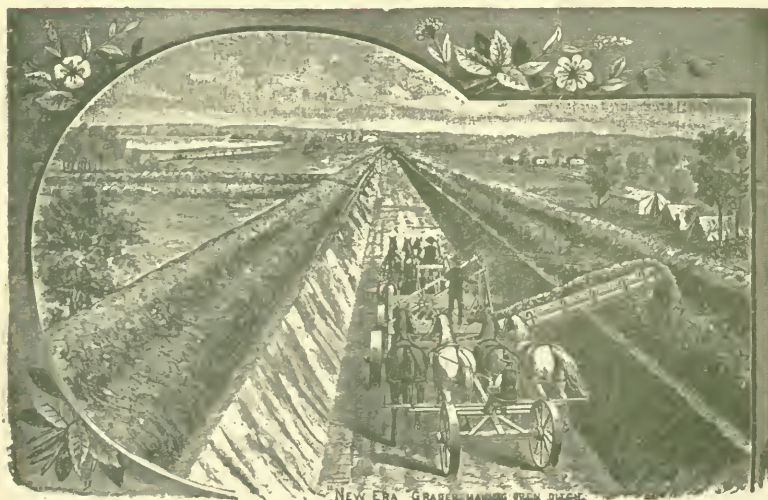
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Arrangements have been made with the **HOME-SEEKERS ASSOCIATION**, whereby the **IRRIGATION AGE** offers its subscribers a paid membership in the Association free. New subscribers sending One Dollar for subscription will receive not only the **AGE** for one year, but a full paid certificate of membership, entitling them to all the privileges enjoyed by the other members of the **ASSOCIATION**, including a years subscription to **THE HOMESSEEKER**. Old subscribers can take advantage of this offer by renewing their subscriptions for one year in advance.

THE IRRIGATION AGE.

112 Dearborn St.

Chicago.

The Pecos Valley of New Mexico.

The part of the Pecos Valley which The Pecos Irrigation and Improvement Company has undertaken to reclaim by irrigation, is situated in southeastern New Mexico, extending into northwestern Texas, and comprises a large area of as highly productive agricultural and horticultural land as can be found on the American continent. At intervals along the Pecos River, for a distance of 165 miles, have been constructed dams, reservoirs and canals, furnishing an abundant and unfailing supply of water for 400,000 acres, over one-half of which area is already covered by the canals. The reservoirs have a total capacity of 6,300,000,000 cubic feet of water; the canals, with the main and sublateral, have a total length of 1,500 miles. About 1,500 miles. About 75,000 acres are already in the hands of settlers, of which over 2,000 acres are in actual cultivation, 2,500 acres being in orchards and vineyards. To further develop this region, a standard gauge railway, 164 miles long, has been built through the entire length of the Valley. Towns and villages have been started, of which Eddy and Roswell are the largest, the former having about 2,500, and the latter about 2,000 inhabitants. Hagerman, Otis, Florence, Francis and Malaga are also growing villages. This work was undertaken a little over seven years ago, and has already cost over four millions of dollars. The Pecos Valley now ranks as the largest irrigation enterprise in America, and one of the largest in the world.



A THREE-YEAR-OLD APPLE TREE IN THE PECOS VALLEY.

Soil, Climate and Productions.

The soil of the Pecos Valley is, in the main, a sandy loam, and is of remarkable depth and richness. The climate is warm and sunny, practically winterless, with long growing seasons, and likewise possesses wonderful health-giving and restoring properties, especially for pulmonary and many other chronic diseases. This soil and climate, with the abundant water supply unite to produce bountiful crops of all the grains, grasses, berries, vegetables and fruits of the temperate zone. Such forage crops as alfalfa, sorghum, Indian and Egyptian corn grow most luxuriantly, making the feeding of cattle, sheep and hogs a most profitable industry. The sugar beet attains a perfection not reached elsewhere in the United States,

if in the world. A beet sugar factory, with a daily capacity of 225 tons of beets, is being built at Eddy and will be in operation November 1, 1896. To supply this factory the farmers of the Valley are now putting in fully 2,500 acres of beets, for which the sugar factory has contracted to pay \$4 per ton delivered at any station on the Pecos Valley Railway, the company paying the freight to the factory. At this price, and with the large yield per acre in the Pecos Valley, the farmer should clear all the way from \$35 to \$75 per acre from his crop of beets.

In the raising of fruits the Pecos Valley will take its place among the most highly favored sections of our land. All the standard fruits of the temperate

zone are successfully raised, while several of these attain a perfection rarely equaled and nowhere surpassed. At the head stand the apple and pear, closely followed by the peach, grape, nectarine, apricot, plum, prune and quince. All the small fruits grow in abundance. The fruits of the Pecos Valley are without blemish, superb in form and coloring, and of unequaled flavor. In a few years they will be found in all the great markets of the country, commanding topmost prices because of their beauty and perfection.

Social and Educational.

The Pecos Valley is being settled in the main by progressive and intelligent people, the majority being Americans, mainly from the Central West. As a result, schools and churches are found in every town and village in the Valley.

The Pecos Valley, while attracting the general farmer and fruit grower, holds especial attractions for those whose health requires an outdoor life in the dry, elevated region of the Rocky Mountain plateau; and these will there find not only the health they seek, but profitable occupation as well. Not only does this life appeal to the health-seeker, but also to the thousands all over our land, and especially in our large cities, who wish to exchange the life of grind and drudgery and marrowing industrial conditions, for one of independence and a larger hope for the future.

For prices of land, and terms, with copies of illustrated publications, address The Pecos Irrigation & Improvement Co., Eddy, New Mexico.

THE IRRIGATION AGE.

VOL. XI.

CHICAGO, FEBRUARY, 1897.

NO. 2

THE PROGRESS OF WESTERN AMERICA.

Irrigation Legislation in Kansas. There seems to be but little expectation that the Kansas Legislature will do more than appropriate a limited amount of money to carry on the work of irrigation survey and experiment inaugurated two years ago. The prevailing impression seems to be that the work should be placed in charge of the State Geologist with possibly a provision that the superintendent of forestry be authorized to spend a couple of thousand dollars in experimentation. The recent change of political complexion is responsible in a measure for the desire to do otherwise than follow the precedent established by the republican administration. It must in justice be admitted, however, that the work accomplished with \$30,000 appropriated by the last legislature is of a preliminary character only. This is due in part to the restrictions and conditions imposed with the appropriation. The report to the legislature just issued by the Board of Irrigation Survey and Experiment contains many valuable geological maps and surveys prepared by Prof. Haworth, of the State University and a mass of information resulting from the two years' work. It is to be regretted that the nature of the problems to be solved were not more thoroughly understood in the beginning in order that the work might have been pursued with definite objects in view. The board is to be congratulated, how-

ever, upon the able manner in which it undertook to accomplish the task set before it.

A Little Activity Needed. An awakening is needed among the friends of irrigation in Western Kansas. For a long time they have accustomed themselves to look on everything with a dull eye and but little effort has been made to encourage the growth of interest in the subject or to set before the public a few of the things already done and attract some of the immigration which has been flowing across the state and locating elsewhere. The time is at hand for organization and active work and unless it is done immediately there will be lost the advantage of the revival in the movement of population.

The Situation in Colorado. The irrigation situation in Colorado is a peculiar one. It is remarkable mainly because no united effort is being made to accomplish something definite and tangible. A number of bills have been introduced in the state legislature but they are confined to matters pertaining to some particular limited locality and are conflicting in many provisions. The most noteworthy advancement seems to be in the direction of utilizing land under the Carey law. Surveys, plats and filings have been made of two large areas—one in the northeastern part of the state adjacent to Greeley and the

other in the Arkansas Valley. Work has been already begun on the reservoir site for the northeastern enterprise, which is practically a modification of the old Pawnee Pass proposition. It is definitely announced that the funds have been secured and the work will be rapidly pushed to completion. This enterprise is the result of the tireless energy of Geo. H. West with the able co-operation of D. A. Camfield, both of Greeley. It has the honor of being the first segregation in Colorado under the provisions of the Carey law. B. L. Winchell, the General Passenger Agent of the Union Pacific, Denver & Gulf railroad is highly pleased with the prospect.

The Need of Settlers. Tens of thousands of acres of land, under ditches in which water is flowing, are awaiting the coming of the settler. Irrigation systems completed at tremendous expense are languishing and unprofitable. Railroad revenues are diminishing and industry is stagnant. These are not the out-pourings of a pessimist nor the vaporings of a diseased mind, but the result of a calm survey of the irrigation field in the spring of the new year. In order to arouse it may be necessary to startle those who have looked, if not complacently at least with but little disquietude, upon conditions inimical to the best interests of irrigation and the Great West. It is not hard to force the ultimate result unless the course is changed. But the time is here for a change and the remedy is plain—prices of land and water reduced to a reasonable basis and active immigration work. The settler is the salvation of the irrigation company; he is needed and with proper inducements and work he can be obtained.

The South After People. It must certainly be admitted that the southern states are more active in their efforts to induce immigration than any other portion of the country. All of the southern railroads, including those which run no nearer to Chicago than the Ohio river, maintain representatives and land agents there and in many cases exhibits of agricultural products. Again the southern states, through their accredited agricultural and industrial commissioners, have prepared hand-books

setting forth in detail the resources of the counties as well as the states at large. A great amount of this literature has been distributed through the medium of the Homeseekers Association. Kansas is the one exception among the western states to exhibit a spirit of patriotism in this respect and the souvenir of the Sunflower State, prepared under the able management of Hon. W. C. Edwards, ex-Secretary of State, has been distributed far and wide with beneficial results. Will the other states follow the example of Kansas or allow immigration to pass by through pure neglect.

A Chance for the West. The outlook for western immigration is more favorable at the present than it has been at any time during the past two years. The wide-spread business stagnation has forced many country people into the cities and it is now going to send them back and many city people with them. The professional man, the clerk and the mechanic feel that their tenure of a sustenance is uncertain. They have waited patiently hoping for better conditions, which did not arrive, and they are now ready to take advantage of reduced land values and emigrate. This has been clearly demonstrated at the meetings of the Homeseekers Association during the past three or four months. Previous to that time the interest manifested was of a lukewarm character. This has changed. The people are eager for information concerning lands, but it must be reliable. No more extravagant land schemes with a thousand dollars an acre profit will be swallowed, nor even half that much. No imaginative and flowery prospectuses need apply. A plain, candid statement of facts is wanted and will receive careful consideration. Is the West ready to seize the opportunity?

Western Apathy. An extended trip through the west has convinced the writer that there is a lack of common purpose and united effort in behalf of irrigation. This is clearly detrimental to the best interests of every western state. While individuals may differ as to methods there should be no difference as to the necessity of united and active work. For nearly two years irrigation has slumbered. There has practically

been no construction work going on and what is just as important, there has been no organized movement with irrigation as its watchword. Of course there are reasons for this stagnation. The unparalleled industrial and financial depression has prohibited capital from seeking outlet in new enterprises, especially as many of those already in existence have proved unprofitable. Again an almost inconceivable lack of public spirit among western business men regarding this most important question, is responsible in a measure for the failure of public work, although this could largely have been overcome if some broad-minded friend of irrigation had been willing to devote a little time to arousing public sentiment. Organization and active work are needed and some one must be unselfish enough to sacrifice minor personal interests that the work may be adequately carried on. The opportunity is here and the time is now.

Activity in Cattle Industry. There seem to be indications of a revival in the cattle industry that if of a genuine lasting character will prove of the greatest benefit to western interests in general. Cattle are now being purchased in large quantities to be fattened during the spring and summer and sold in the fall. A prominent financial man in one of the western states estimates that over 50,000 head of cattle will be feeding in his county inside of the next few months. This activity means higher prices for hay and corn and other feed and increased business in other lines.

Arrested Development. The one serious trouble with the United States is that its development was arrested at a critical moment, at a time when it should have assumed a form of greater and more intense activity. The pilgrim fathers of Massachusetts, the pioneers of the South and the middle West, went forth into the wilderness and conquered new empires. The wave of civilization starting at the Atlantic seacoast and sweeping back to the Alleghanies and through the valleys of the Ohio and the Mississippi marked, in its various stages of progress, epochs in the history of the country, and the nation prospered as no nation on the face of the globe had ever done before.

Reaching the Missouri river it paused *and it is still pausing.* The tide of settlement overlapped in spots. It subdued Kansas, Nebraska and South Dakota until the drouth drove it back. It broke through the mighty Rockies here and there. It went around to the Pacific coast, but the grand total of area subjugated to the use of man was but as handful. Today the East, thickly populated and developed, is groaning under its weight of idle labor and capital; the West, practically a virgin country, is groaning because of the lack of labor and capital to open and develop its almost unlimited resources. Let the march of progress and conquest be resumed.

Irrigation Opens the Gateway.

Agriculture is the basis of all human industry, and irrigation is the mainstay of agriculture. Upon the arid lands of the West can be supported a population equaling that of the entire country at present. This can be accomplished by intensive and diversified agriculture by irrigation. Fewer acres better cultivated will yield larger returns than a vast area thinly scratched over. The full significance of this can be appreciated when it is considered that forty-acre irrigated farms means four times the population that 160-acre farms will allow. Again, the farmer who has the water of the irrigation ditch at his command is one of the most independent of men. His crops are assured. He diversifies his operations and produces all himself and family consume, with a surplus which can be exchanged for clothing or other necessary articles, or money to be reserved for old age. He is practically free from outside influences.

The Age Vol. XI.

The eleventh volume of THE IRRIGATION AGE began with the last issue, and this is an opportune time to again outline the work which this publication has undertaken. Believing firmly in irrigation as the only method of farming by which plentiful crops can be assured every season, we still further believe that irrigation presents the one broad firm foundation upon which Western prosperity can be erected, and that it will act as a safety valve through which can escape the discontent now prevailing. The

reclamation and building of homes on thousands of acres of arid land, the development of the immeasurable resources of the mighty West offers profitable employment to both labor and capital now stagnant, and better than all else, it offers a home and a living to the man who is willing to work.

The Age and its Friends THE AGE is first of all the friend of the farmer—the man who produces with the aid of God's sunshine, and the irrigation ditch, the grains and grasses and vegetables and fruits and flowers of the farm and orchard. It is the friend of the stockman whose horses, cattle, sheep and hogs are the source of so much wealth. It is the friend of the miner, whose toil adds to the store of the world's wealth of minerals, and through whom a vast market is opened for agricultural products. It is the friend of every honest enterprise which has for its ultimate object the development of the West. But we want to make it very plain that there are many things to which THE AGE is opposed. It is opposed to slovenly methods of farming, fruit growing or stock raising. It is opposed to the waste of the precious water supply. It is opposed to unnecessary restriction in the use of water for irrigation. It is opposed to dishonest bonding schemes and wildcat irrigation propositions. It is opposed to land companies or agents who are unfair in their dealings or who make misrepresentations and obtain settlers by fraud. It is opposed to wanton destruction of the forests, and more than all else THE AGE is opposed to that spirit of apathy and procrastination among the business men of the West, at a time when it is so nec-

essary that they arouse themselves and organize to carry on in an active and aggressive manner the work in behalf of the development of that section of our country which is to witness the triumphs of twentieth century civilization.

A Journal with a Purpose. These are but a few of the aims and objects of THE IRRIGATION AGE of which the New York Sun said "It is a journal with a history, a purpose and a future." It is working earnestly, conscientiously and perseveringly in behalf of what its sober judgment dictates as best for the interests of the public at large. It is working in behalf of Western America on a broad scale. Its scope includes the industrial, financial and social features of the conquest and upbuilding of a mighty empire. We shall neither pause nor rest until this great work is fully under way.

Will You Co-operate? And now, dear reader, we ask your co-operation. If you believe in THE AGE, if you believe in its work, why not help us carry it on. You may not do much, but every little will assist. Aim to convert at least one person to the doctrine of "The Conquest of Arid America." Hammer on this point until they feel that they have a direct and personal interest in this campaign,

THAT IT MEANS PROSPERITY FOR ALL.

Send a copy of THE AGE to some friend or relative in the east, that they may keep in touch with this momentous question and appreciate the opportunities offered in the west. Assist us by suggestions and criticism. We need your aid and you will not regret extending it



UTE INDIAN RESERVATION IN COLORADO.

NEW MOVEMENT FOR HOMES.

BY GEORGE E. GIRLING.

FOUR years ago in the winter of 1892-93 were heard the portentous rumblings of the severe financial panic which followed so swiftly after, paralyzing commerce and crippling industry. These four years have taught the present generation of Americans a most severe lesson in industrial and individual economy. Industrial stagnation has forced strange thoughts into the minds of every working man and woman. Financial, industrial and social problems have received a consideration at the hands of the great mass of the people never before accorded them. Out of this universal effort for relief from existing conditions new ideas are being developed. Financial theories and governmental policies are being discussed, but not with one-hundredth part the vigor and earnestness that is devoted to the individual question, "How shall I best obtain a livelihood?" The hopes and aspirations of the mind have temporarily been subjugated to the necessities of the stomach.

It has become a question of a living for every man and woman and child. Fewer hours of labor and less pay for the working man and more hours and smaller profit for the business man have taught them both that above all things an assured living is to be desired.

The depression has been felt in all sections and all avenues of industry but probably in none to a greater extent than in the process of developing the natural resources of the country where, it has culminated in the (almost absolute) stoppage of all progress. With the one exception of gold mining in the Western States there has been no effort made to inaugurate any industrial or commercial enterprises and immigration to agricultural lands has been allowed to stagnate. But the beginning of 1897 marked a partial revival of life in the general business conditions of the country. It has been heralded as the year beginning another epoch of prosperity. The public mind is ready to grasp at confidence but the march of time will demonstrate the realization or disap-

pointment of its anticipations. The public question to be considered is "How best to hasten the day of realization of general prosperity?"

THE NEW HOPE.

For many years there has been a steady and rapid increase in the population of the cities. One of the first effects of the panic was to still more rapidly augment this increase, but I believe its later effects will be the turning of a strong tide of immigration to the rural districts, because the people have thoroughly learned that it is easy to starve in a city while on the farm a little effort will provide three meals a day which are life sustaining even if unaccompanied by luxuries. The turn in the tide has come. "Back to the land" is the cry and we may confidently look forward in the near future to a broad and deep stream of homeseekers flowing out of the factory towns and cities searching for locations.

COLONIAL DEVELOPMENT.

The development of the future, however, will not be carried on in the same manner as has been the settlement of agricultural sections in the past. It will not be an individualistic effort but some practical application of the principle of association for a common purpose. No widely scattered ranches, large and lonely, but closely settled neighborhoods with educational, social and religious privileges. The farms will be small in size and immediately adjacent to the town. The crops will be diversified and under irrigation sure, industries will be provided to consume the crops and furnish a profitable market therefor. Transportation facilities will increase with the increase of population. The charms of country life and the advantages of the town will be blended. And the city man will be an important element in all of these communities.

"TWENTY ACRES ENOUGH."

On twenty acres of irrigated land can be produced practically everything nec-

essary for the ordinary sustenance of a family and a surplus to provide for misfortune or old age. That this is true has been proven many times in nearly all parts of the irrigated west. In Utah, at Greeley, Colo., at Garden City, Kansas and elsewhere the results have been extremely favorable to the small irrigated farm, intensively cultivated. It is no longer an experiment but an actual demonstration of fact that such results have been, are being and can be obtained by the use of ordinary judgment and care and work. An independent living awaits every family willing to seize the opportunity. In future issues of *THE AGE* will be presented detailed statements of the actual production on farms in the various portions of the western states. Farmers are invited to send in such statements giving the area of land cultivated and the crops produced and to the first person in each of the western states and territories sending in such statement I will give free any one book selected from the list published in *THE AGE* for January.

A GREAT OPPORTUNITY.

If the ground-work of high average prosperity exists anywhere it exists in Western America; a blank page awaiting the giant hand-writing of human industry; not blotted with the sufferings of starving millions. Upon it will be engraved the achievements of a century of greater progress than the world has seen. It is waiting the electric touch which will rouse it to life and activity. Will the men of the west join in a concerted

effort to hasten the coming of the dawn of prosperity? The opportunity is at hand for a movement of population, every indication points to a revival of immigration. The wage worker, the business and the professional man alike are determined to concentrate their efforts upon an attempt to obtain a sustenance which will be ample and at the same time secure; to go where no threat of tariff or currency manipulation will snatch the bread from the mouths of the children; and where they can live under their own roof and be independent. A broad highway for such a movement has been built by the work of the Homeseekers Association. Through the medium of this association will pass thousands of settlers seeking locations.

HOW IT CAN BE UTILIZED.

How best to attract and keep and care for this movement of population should be the thought of every friend of irrigation and the west. It can be done intelligently and profitably. It can best be done by means of industrial colonies. These should be planned carefully and wisely and placed only in the most favorable localities. Colonial life fosters general prosperity and it is attractive. The organization of these colonies has already been started. It is gathering headway rapidly. The ideas discussed at the meetings of the Homeseekers Association have met with popular approval. It remains to give them practical expression by the inauguration of the actual work of settlement and the building of homes.



A HAY FARM IN A COLORADO VALLEY.

THE ART OF IRRIGATION.

CHAPTER XX. A FEW FINAL REMARKS.

BY T. S. VAN DYKE.

The methods so far described cover all practical ways of managing an irrigating stream on any considerable scale. All the methods of the world can be reduced to some one of them and you will do well to look with care on anything purporting to be a new system. There will of course be improvements in the detail of delivery and distribution upon the land, but in the essential principles that govern the handling of it there will be no change. The best irrigators of America have merely refined upon what is old in China. There they were compelled to get the greatest quantity of produce out of the smallest amount of ground before Columbus was born. But the Indian and the Mexican irrigated where land was no object and no economy in water or fertilizers necessary. Too many of the irrigators of the United States have imitated the latter and irrigation was, even in California, a practical failure until the new comers went to the Chinaman instead of to the old native Californian as they all did at first. They have merely improved upon the instruction until to day the teachers are far behind in many things, though none can yet surpass the Chinaman in producing the largest amount of vegetables to the acre with water.

I had intended to go into the subject of irrigation machinery but it opens up territory large enough, in connection with the building and management of irrigation works, for a book in itself. I shall probably take it up in that line some day and will pass it now with a few words. In "Irrigation Farming" by Lute Wilcox the reader will find treated from a standpoint different from mine much that is very valuable and every one should read it. I have had to omit a great deal for brevity, although this work is now longer than intended.

It is too late to question the utility of lifting water for irrigation. Whether you can afford to pump or not is merely

a question of what you want to raise and what you want to do with it. You may raise it to eat when you could not to sell and *vice versa*.

As a rule all irrigation machinery is honestly rated by the makers. They are not to be expected to say how much it will lose in friction on complicated bearings, or unnecessary, stupid or bad ones. Least of all can you blame them for not knowing how much of the power you propose to throw away in overcoming friction on small pipes when larger ones would cost but a trifle more and carry two or three times the amount with the same power. Engines are sometimes rated at their theoretical power not allowing for the loss on their bearings which may be as high as thirty per cent. The maker will give you a fair allowance for this but he cannot allow for what you fasten to it. Nor can he be blamed if you run the machine at a low efficiency because you have a well that pumps out so easily that the machinery must be slowed down to allow it to fill. All the machinery I have ever seen was miserably handicapped in its operation by one of these causes and generally by both. Often the buyer is not getting over forty per cent of the power and I have seen many in which one-half was wasted in overcoming friction in pipes too small, rough or dented, and with one or more right-angled bends. The majority of windmills are doing less than half duty from these and other causes. And you cannot expect good results from steam and none too good from gasoline unless the machine can run at full power or very near it for a long time. The gasoline loses almost nothing in stopping or firing up but even it does best running steadily at a good speed for a long time. You will never invest a few dollars better than in getting a competent engineer to figure all possible friction out of your works. No matter how cheap fuel may be you cannot af-

ford to waste much of it in pumping against friction.

A full feed of water at the lower end is almost as important as the height of the lift. If you can throw a stream of twenty-five to fifty inches for two or three days at a time, so that there will be no more pumping to do for several weeks, you can lift water cheaply with steam in many places. Ten days run of thirty-six and a half inches would be a whole inch for a year, and if divided into five periods of two days each or into six periods of twenty inches running three days at a time it should be enough for ten acres in almost anything but alfalfa, oranges, lemons or some kinds of garden stuff in a dry country. But the ordinary farm well surrenders to such a draught in about three minutes. An extra well in earth or sand may stand it for a few hours but after a few days begins to dry and when it does it is gone. It wants a pond or flowing stream or a well on a good gravel bed, or some big crevice in rock, connecting with some big watershed. The well should generally be large, with drifts so as to give sufficient percolating space, or you may find it fail even with a good supply back of it. In such cases don't try to save a few dollars by being your own engineer. The man who is his own lawyer finds out very quickly where he is hurt but the man who is his own engineer may scratch a long while before he suspects he has the seven years itch. The work is so simple that no engineer would charge as much as you lose in a week by trying to dispense with him.

In orchard work of all kinds in the arid and semi-arid countries the rabbit is a factor in irrigation. The festive "Jack" will travel miles at night to nibble the bark on young trees at certain times of the year and there are times when no amount of alfalfa will stay his passion. The cotton tail is bad enough. A low fence will keep either out as they do not jump high, but it is much safer to protect the trunk of the trees when young as they do not trouble it when old. Tarred paper and wire netting made into a roll and tied around the trunk are used but the best, and cheapest, is the Yucca Veneer made in Los Angeles of the "desert palm" by the Yucca Manufacturing Company. This is the most

popular with the fruit growers on account of lightness and durability, ventilating the tree and at the same time keeping the sun from it, yet being as light and convenient to ship and put on as paper.

On some kinds of soil you may be appalled at seeing the water disappear like magic at the first irrigation into the many holes made by gophers and other animals, and often a large tract may cave in so that it seems a hopeless task to irrigate it. But these troubles will soon cease with regular and sufficient irrigation. Even without any holes, as on some parts of the desert where no animals live, the soil seems at first so awfully thirsty that you think it ridiculous to try to wet it enough. But you will find this difficulty pass away after you have the subsoil well filled with moisture and you will like your desert soil better than that of the wet country. As a rule you will find it not only quite as rich but so free from hard pan or other impediment to good drainage that it is worth much more. I would far rather have the soil of the Salt River Valley in Arizona, on which absolutely nothing of value can ever exist without irrigation, than the richest prairie of the west underlaid by clay or other impervious material.

But you must not infer from this that soil with hardpan cannot be well irrigated. They cannot be drenched while the well drained soil will stand drenching better. From stupid work many a man has concluded that his soil was not susceptible of irrigation. In many a section all attempts have been abandoned for this reason. There is no soil that cannot be irrigated but some can be handled more easily than others by any one and will not suffer so much from bad work. There are some that cannot be irrigated except in a certain way. If there is a clay or other subsoil that interrupts the drainage it should be well filled with moisture by winter irrigation if it is porous, the moisture retained by as good cultivation as is possible, all trees planted upon it and never in it unless a hole is dug or blasted through into some open material, it should then be irrigated carefully and never treated to too long a run of too much water. In the case of tough clay

with a thin top soil it is best to crown the rows of trees a little, scrape away the top soil and spread out the roots of the trees and never make a hole in it, heap the top soil around it and do not let the water come near the tree. In summer, irrigate the intermediate space. In winter you may wet it anywhere if the trees are dormant but in summer be careful. With good winter irrigation and cultivation the roots spread out to the moisture and burrow in to the clay in such a way that the tree will not be hurt.

Many have an idea that on very gravelly ground you must water very often and some keep large streams running nearly all the time. Some say you have to run large streams to soak it at all, while others will say that it can't be flooded at all and still others will aver that you cannot irrigate it in any way. Pure nonsense all of it. I must repeat there is no soil that cannot be irrigated. Anything with enough fine material to be worth planting can be irrigated without running water one-quarter the number of times supposed necessary by verdancy. Any soil that will hold water in the ditches necessary to get the water up to it will hold it long enough to flood. If it will not, it is not worth

working for any purpose. As a rule all you have to do is to make the checks small enough and the irrigating head large enough. If the head is too small in proportion to the size of the check you will of course come to grief, and find most of the water gone before the whole bottom of the check is covered. But if the head is large enough and the check small enough this cannot happen unless your soil is a nest of cobble stones with no fine material between. A head of one hundred inches or two cubic feet a second will cover about twenty-two feet square three inches deep in one minute. You will find no soil worth anything that will take one-half an inch in depth in that time. If you should find it still too porous, yet can use it for anything, make the checks still smaller or the head still larger. But nothing that you can do will be as bad as keeping a stream running all the time. You might better cut the checks to ten or even five feet square if you cannot get a large enough head for twenty-foot checks. And sometimes you may do the same thing with furrows by making the streams larger, but in some way or another you can irrigate every kind of land no matter what its shape or quality.

To be concluded in our next issue.



YOUNG ORANGE TREES IN A NURSERY.

DEVELOPMENT OF FRUIT EXCHANGE IDEA.

BY FRANK S. CHAPIN.

AS California fruit came into market so much faster than facilities for its disposal developed, especially in times when the mass of consumers were down to bed rock and cutting off all luxuries, the growers took it into their own hands.

Some of them are in the position of the boy kicked in the face by a mule who asked his father if he thought he would ever be as pretty again. "No, my son, but you'll know more."

Now some of them know that it is as much of a trade to sell goods as to produce them; that there is as much advantage in curing fruit on a large scale with every facility as the creamery has over the farm dairy and that the plan by which you can reach the retailer most directly and make the deal most interesting for him is the best.

They have found that prunes yield all the way from 25 per cent to 45 per cent of their fresh weight and other fruits in proportion and that flavors vary as much or more than yields. So it is even harder than in the ordinary business to agree upon a just basis of credits.

The banks advancing money on fruit in warehouses, cured and graded, have not been pleased owing to the policy of exchanges of holding too long on declining markets. Under such considerations "The Visalia Exchange" has adopted the policy of storing each man's crop separately in their warehouse and grading and packing to suit order of buyer as goods are shipped.

Whenever a customer wants to draw an advance he consigns the goods to some commission house, forwarding sample and authorizing them to act as his agent in disposing of same. Whenever they secure an offer it is submitted for acceptance and goods are sold from sample f. o. b.

The house acts as producer's agent in guaranteeing goods up to sample and

has such arrangements for arbitration that trouble seldom occurs.

Houses are disposed to encourage the trade in ordering goods packed under their own brands and then crowding their sale as specialties. When a traveling man is able to show a customer samples of nearly all the stock in the market and to furnish same in any style of package he is in very different position from a huckster along the water front whose store is crowded with dirty sacks of fruit that the worms are destroying, and there are so many more sellers than buyers that he is glad to have it out of his way at any price.

The time is coming when it will seem as important to send cured fruit in packages that will reach the consumer with recipes for cooking as it is to pack oatmeal or baking powder in that way.

In co-operative drying plants it has been found hard to avoid such favoritism as made the work too expensive.

It has been suggested that after the neighborhood has equipped the plant they let the work of curing to the lowest responsible bidder with as careful specifications as they would make for a bridge or a house. He might hire the same people but they would not have the same pull and could be controlled.

As the amount of money that its net proceeds pays interest or fixes land value and determines rate of development, questions like the above have a deep interest for all engaged in developing the arid west.

We summarize: Neighborhood curing plants; curing done by contract; crops stored separately at warehouse; advances made by commission house; sales made by houses employing travelers to interview retailers; goods packed to order; dealers encouraged to order private brands and push sale of specialties; advertise merits of goods and methods of cooking on each package.

THE DIVERSIFIED FARM.

In Diversified Farming by Irrigation lies the Salvation of Agriculture.

THE AGE wants to brighten the pages of its Diversified Farm department and with this purpose in view it requests its readers everywhere to send in photographs and pictures of fields, orchards and farm homes; prize-taking horses, cattle, sheep or hogs. Also sketches or plans for convenient and commodious barns, hen houses, corncribs, etc. Sketches of labor-saving devices, such as ditch cleaners and watering troughs. A good illustration of a wind-mill irrigation plant is always interesting. Will you help us improve the appearance of THE AGE?

ALFALFA.*

When to Cut, How to Cure and How to Stack.

BY W. H. FANT.

I AM confronted with three questions.

It is an easy matter to propound questions, but often, not an easy task to give clear, well-defined answers. We may feel quite competent to properly discharge certain lines of work, but to tell how it is done, in a manner that will be fully understood and comprehended by others, will also prove a difficult task. One may read the best essays on the subjects under consideration, yet it will require experience, and the more the better, to cut, cure and stack alfalfa to the best advantage.

When to cut? The proper time to cut is when it fairly commences to bloom, let that be May or June. Unlike other plants which yield but one crop in the season, alfalfa begins growing again, immediately after it is cut, so that what diminution of weight may be suffered on account of early cuttings is made up in after-growth and subsequent crops. Do not cut too much at once or more than can be readily handled when cured, for reasons which will be given later on. The first crop contains more water than will be found in subsequent ones, and the mower, in consequence, may be used at all times of the day without prejudice, but later on in the season, the best time to cut is in the forenoon, while the air and alfalfa are yet to a degree, moist; often the liquidation of the moisture by the action of the sun and drying winds, the knives of the sickle will accumulate gum, while in use rapidly, thus causing heavier draft, extra wear and friction on all parts of the machine, especially the

sickle. As a remedy, water should be kept at one corner of the field, and applied by pouring on the knives of the sickle each round, which will loosen the gum and cause it to rub off easily. Otherwise, sooner or later a breakage of the mower will occur somewhere, (usually the sickle-head), then, as is often the case, the mower, the agent who sold it, and the manufacturer, come in for a full share of abuse, when the fault was with the driver, whose mind and body had been allowed to lapse into a state of inertia.

Next, how to cure alfalfa so as to retain its bright color and nutritive properties, requires watchfulness, vigilance and prompt action at the right time, or the best results will fail to be obtained. Would advise the alfalfa be raked into winrows as soon as practical, that is as soon as it has dried sufficient to be taken up without being unduly trying and slavish to the rake, and allow it to cure principally in the winrows, where the green color and leaves are better retained. On account of the humidity of the atmosphere, the first crop, as a rule, cut in June, requires to remain untouched as it falls from the mower, for a longer period to cure than the after crops; the time to so remain must be determined by the drying out conditions, then existing, usually from one to two days. The following crop can frequently be raked the same day it has been cut. During the drying months of August, September and October I have had the rake follow the mower within two or three hours after the cutting; for, unless quickly placed in winrows a loss in color, leaves and weight will follow. After being

*Address delivered before Finney County Farmer Institute Garden City, Kans.

raked into winrows and the work accumulates so that it cannot be readily stacked when cured, it should be placed into nice, well rounded shocks, which protects it from the drying sun and scorching winds and I am not sure, but its the very best way to cure the alfalfa. In the shock the alfalfa may be allowed to remain until one can feel certain it has become ripe for the stack, which can be determined largely by taking hold of the stems and see if they will break readily by twisting, if instead of breaking when bent the stems yield like a string, then it has not cured sufficiently to be placed in the stack with safety, as it will be almost certain to stack burn, which renders it unfit for commercial purposes or for feeding to horses.

Alfalfa should never be moved when the dew is on and if possible rain should never be allowed to fall upon it between the cutting and stacking, as the rain bleaches it, and the leaves fall off readily afterward. When properly cured it should be placed in the stack, and the sooner it is done the better. At this period above all others, there is not a place to be found for a lazy or drowsy man, for if allowed to remain in the winrow it dries out and the leaves more readily fall from the stems, a rain also is liable to come unawares, and does it much damage; then push the stacking and its color, weight and nutritive qualities are the better preserved. If a large crop is to be harvested and fifteen to twenty acres have been cut and made ready, two or three go-devils to convey the alfalfa to the stack may be used to good purposes when two good stout men should be on the stack, one of whom should take charge of shaping the stack and to build a good stack he cannot too well understand this work; watching the sides and walking over the stack occasionally to find out and fill in the places that need evening up, is very essential and at all times keeping the center full and highest, especially as it nears the top. Alfalfa will settle in the stack very considerably in a few days, therefore retopping once or twice would be very advisable, and until it settles properly a good-sized canvas might be used to great advantage to prevent the rains soaking in, for new alfalfa stacked will not turn off water as it falls like other

grasses, but the rain readily soak in, doing much damage if the tops are not carefully protected in some way. It is now time I should close, but will take the liberty to say that alfalfa is our main and most valuable crop. It pays a greater per cent. of profit than any other. Cattle fed on it through the winter come out in better shape to place on grass than from any other one feed as it contains just the elements needed to make and develop bone and muscle and give health and vigor to the animal. Not only the best bred Hereford, the Shorthorn, the Galloway, the Poll-Angus and other strains of high grade cattle (of which Kansas produces among the best in the United States) but the stringy, knotty, tow-headed stock of Arkansas and Louisiana, when once they become introduced will run and bawl for it and from its use will widen out rapidly. Instead of baling our alfalfa and shipping it to the heathens in the different cities of the east who are slow to become acquainted with its merit and value, we have at last become fully persuaded that the best way to dispose of it is to compress it into the stomachs of cattle. With alfalfa and cattle, the bright shining star of hope and success beams upon us.

CORN UNDER IRRIGATION.

BY A SUBSCRIBER.

THERE has been much said and written on the different methods of irrigation and the best means of getting water over the ground, and as what has been the experience of the writer and a cost of time and labor may be of benefit to beginners in irrigation, we will give what we have found best adapted to this western country where corn and wheat are the principal crops raised. To put in corn we find the best method is what we call double listing. That is we list out the stubble ground in the fall and give it a thorough watering in October, running the water down the furrows till the soil will take no more. This leaves the field in good condition to catch winter moisture and keep the sub-soil moist, which in a country where irrigation is necessary, is almost always dry. When planting time comes these ridges are thrown out with a lister with a good sub-soiler attached and planted

with an ordinary corn planter.

The check-rower is used when it is desired to cultivate both ways or planted in hills but drilling is the general custom, as the ridging leaves the furrows in better shape to run the channels or stream of water between each row of corn which is necessary. If the corn has been cross cultivated it is more difficult to get an even channel or run of water, as the ridges are imperfect and in case we have rain at the time of watering and the fields are not properly drained there is danger of getting too much water in the low places which is a detriment even in dry western Nebraska. Another point in favor of planting in listed furrows is this: In this country we are subject to high winds about the time of the crop growing season and where the ground has been ordinarily plowed the corn growing on this loosened soil after a thorough wetting will be blown over first one way then another until the brace roots are broken or pulled loose. We had a field of corn planted on plowed ground that was very promising, just when we had the ground well soaked we had a storm accompanied by high wind which bent the corn to the ground, the following night a high wind blew from the opposite direction, laying it over the other way, pulling up the brace roots and tangling badly. Another field planted on listed ground withstood the wind with little or no evil effect.

In regard to watering the second time: do not let the corn suffer or even get dry before applying the second time or even the third watering. We had a crop mature fully that was planted June 1st, and watered late but the water was kept running till the corn showed signs of maturing, while another field planted May 10th, watered as soon as laid by July 1st, was then let get dry before the second watering, took on a second growth after the second watering and did not mature fully before the cold nights and frost caught it. The corn was loose on the cob and of a chaffey quality. We also find that by listing out the stubble and thoroughly watering and then as soon as the ground can be watered, closing or filling the furrows with a disc harrow, we have a splendid seed bed for the sowing of winter wheat which will come up quickly and get a good growth

before winter sets in thus covering the ground and retarding the evaporation of the moisture during the dry season of early winter.

American Imports.—Sugar is our largest article of import. Last year the total reached nearly \$90,000,000. Coffee comes next, with \$85,000,000; wool \$33,000,000; raw silk, \$27,000,000; woods, \$21,000,000; hides, \$20,000,000; india rubber, \$17,000,000; goatskin, \$14,000,000; tea, \$13,000,000; vegetable fibres, \$11,000,000; chemicals, \$10,000,000; gums, \$7,000,000; soda, \$7,000,000, and other raw materials amounting to a total of \$370,000,000 last year, upon which no duty was paid being 47 per cent of our entire imports. In 1895 49 per cent was free. In 1894 58 per cent. The raw materials which with the exception of sugar, constitute the free list of our tariff came from Brazil, \$71,000,000; Cuba, usually \$80,000,000; Japan, China and the West Indies, Mexico and the countries of Central and South America, which tax every ounce of our products that passes through their custom houses. They have not asked us to admit their products free. We have done so voluntarily; and have thereby thrown away the opportunity to secure similar concessions in return.

Fighting Poultry Lice.—The best time to fight poultry lice is during the winter, when they are dormant. The larger sorts can be killed with insect-powder if it is sprinkled among the plumage of the fowls. The insects that produce scaly-legs can be killed by greasing the shanks thoroughly with any kind of vegetable or animal oil. This should be rubbed into the legs thoroughly, and worked down until it gets under the scales, where it will reach the insects and kill them. For the red mites heroic measures are necessary if they are present in any considerable numbers. The perches and all nest-boxes or other inside furnishings should be removed, and then the whole inside of the house should be drenched with boiling-hot water, after which it is a good plan to paint the inside with kerosene, and then thoroughly whitewash the house inside and out. The perches, nest-boxes, etc., should be treated in the same way before being replaced.

Production of Beet Sugar.—The following figures according to the "Pecos Valley Argus" show the growth of the beet-root sugar industry in the United States from its first inception in 1830, when but a few hundred pounds were made, to the present time when 40,000 tons are manufactured, and when new factories are being built in all sections of the country. The following beet sugar factories are now in operation: The Western Beet Sugar company, Watsonville, California; the Chino Beet Sugar factory, Chino Valley, California; the Alameda Sugar company, Alvarado, California; the Norfolk Beet Sugar company, Norfolk, Nebraska; the Oxnard Beet Sugar company, Grand Island, Nebraska; the Pecos Valley Beet Sugar company, Eddy, New Mexico; the Utah Sugar company, Lehi, Utah; O. K. Lapham & Co., Staunton, Virginia. New factories are approaching completion, or proposed at places as follows: at Rome, New York, now being moved from Canada; at Menomonee Falls, Wisconsin (Wisconsin Beet Sugar company, Milwaukee, Wisconsin); at Alamitos, California, (the Alamitos Sugar company, Los Angeles, California); at Salinas City, California, proposed by Mr. Claus Spreckels.

PRODUCTION BY YEARS FROM 1830 TO 1896.

YEAR.	ESTIMATED PRODUCTION	YEAR	TONS.
1830	A few hundred pounds.	1884	953
1831-7	None.	1885	600
1838-9	1,300 pounds.	1886	800
1839-62	None.	1887	255
1863-71	300-500 tons per annum.	1888	1,910
1872	500 tons.	1889	2,600
1873	700 tons.	1890	2,800
1874-7	Under 100 tons per annum.	1891	5,359
1878	200 tons.	1892	12,091
1879	1,200 tons.	1893	20,443
1880	500 tons.	1894	20,443
1881-2	Less than 500 tons.	1895	30,000
1883	535 tons.	1896	40,000

Wheat's Northern Limit.—In Europe the growth of wheat ceases with an imaginary line connecting Inverness, Scotland, latitude 58 degrees; Drontheim, Norway, latitude 64 degrees, and St. Petersburg, Russia, latitude 60 degrees 15 minutes. Oats reach a slightly higher latitude. Barley and rye ascend to latitude 70 degrees but require a favorable aspect and season to produce a crop

Best Oranges in Florida.—Professor E. S. Hubbard, of Florida, lately spoke as follows regarding the most desirable varieties of oranges for cultivation in Florida:

"Throughout the orange belt generally, the Red Tangerine is probably the most satisfactory of the earlier ripening class of Mandarin oranges; it can be shipped for the Christmas market. Among the round oranges, Contenial, Parson Brown and Nonpareil are the most satisfactory of the early varieties; they have sufficient acid to make them palatable, and are sweet enough to eat when colored enough for shipping.

For mid-season the Jaffa may be considered the standby. There is quite a long list of mid-season varieties that have little advantage over each other, such as Ruby, Knickerbocker and Amory, among the bloods, and Prolific and Paper Rind among the St. Michaels.

Among the late oranges, I know of no superior to Hart's Late; the tree, in my experience, stood the last cold, as well, or better, than any other variety. The Valencia Late is also desirable."

Uses of Lemons.—A writer in the New York Herald gives the following information regarding the uses of lemons:

"The hands and nails are kept clean, white, soft and supple by the daily use of lemon instead of soap. It prevents chilblains also.

Lemon is often used in intermittent fevers, mixed with strong, hot, black coffee, without sugar. By rubbing the part affected with a cut lemon, neuralgia may be cured. It is valuable also to cure warts and to destroy dandruff on the head, by rubbing the roots of the hair with it. It will alleviate and finally cure coughs and colds and heal diseased lungs, if taken hot on going to bed at night. Its uses are manifold and the more we all employ it internally and externally, the better we shall find ourselves. Lemon juice is useful in removing the tartar from the teeth.

A doctor in Rome is trying it experimentally in malarial fevers with success, but he thinks it will in time supersede quinine."

A VALUABLE RECIPE.

"For fevers, chills, rheumatism or constipation, throw the pulp, rinds and seeds all together with the juice into a vessel of stoneware or porcelain. Sweeten to taste. Pour boiling water over the mass. Stir until the sugar is dissolved. Cover closely and let stand until lukewarm or cold. Drink the liquor freely. A gallon taken in twelve hours has been known to check chills and fever. Do not put the liquor into metal, for that will poison it."

Let us indulge in some figures while on the subject of lemons. Almost every one believes that the use of a lemon a day would prove not only agreeable but of decided benefit to the general health. If, therefore, the people of the United States (70,000,000) should consume but one lemon each per day it would require 85,166,545 boxes of lemons to supply them each year if we estimate 300 lemons to each box. But it will take a long time to convince our people that lemons are better and far cheaper than beer, whisky, cigarettes and doctors.

Farm Secrets.—Cost of producing wheat, corn, oats, hay and all products which farmers produce are common subjects to be found treated in farm papers and which are heard discussed a great deal on the streets when merchants talk about farming. We do not hear so much about the cost of production of coal, iron, calico and coal-oil. The men who produce wares to sell to the farmers keep the cost price secret if they can. They know the cost but do not tell every one. It is not likely that two farmers living side by side can raise corn at the same outlay. We see one farmer becoming well-to-do selling products at low rates while his neighbor is closed out by the sheriff. The cost of production on the farm depends upon the man who does the planning and the work. The producers should know the cost, but it is not necessary for them to tell every one.

A Registry for dairy shorthorns was determined upon at the recent annual meeting of the American Shorthorn Breeders Association in Chicago. Admission must be based upon actual performance at the milk pail.

What the Nations eat.—A statistician compiled the following figures, showing the price of nourishment for the various nations: The average Englishman consumes \$250 worth of food per year; Germans and Austrians, \$216 worth; Frenchmen \$212; Italians, \$110, and the Russians only \$96 worth of eatables per year. In the consumption of meat the English speaking nations are also in the lead, with 128 pounds of meat a year per capita of the population, the Frenchman using 95 pounds; Austrians 79; Germans 72; Italians 52; Russians, 50. The consumption of bread is reversed, being compared to that of meat. The English use 410 pounds a year; the Frenchman, 595; the Austrians, 605; Germans, 620; Spanish, 640; Italians, 660; the Russians 725.

One Source.—"A little house well filled, a little farm well tilled." One source of hard times among farmers in the West is the attempt to work too large an area of territory. New beginners should take small farms, irrigate and diversify.

Black.—Red pepper should never be given to poultry in large quantities. The practice of putting red pepper in all the soft food should be discarded. The best effect from its use is when it is given once or twice a week, and half a grain for each fowl is sufficient.

Care of Stallion Colts.—A contributor writes: "I wean them when about five months old and put them where they cannot see their dams, and if they cannot hear them all the better, as they will then forget them sooner. If I have a good pasture with water and feed troughs handy, they have it; if not, they have a good yard with box stalls to run in and get their feed, which consists of oats and wheat shorts fed separate and dry, all they will eat and clean up well. I also feed good timothy and clover hay, corn fodder and straw, letting them run in bunches of six or eight, selecting those nearest of an age and size to run together. Sometimes they have to be separated when a year old, but I have had them run together until they were 2½ years old. However, as soon as they begin to find out that they are stallions it is better to separate them."

American Pork Proved Wholesome.

—The effort made in Germany to prohibit the importation of American pork and its products has resulted in proving that the charges that it was unfit for food are untrue. The Prussian Minister of the interior issued instructions to the heads of government districts in Prussia to report to him the cases in which trichinae had been discovered in pork imported from the United States and to furnish him with such data as would enable the government officers here to find the persons who had exported the diseased meat. Out of thirty-three districts in Prussia called upon for such reports and data only five reported any cases where trichinous American pork had been found and none of these five sent any data or furnished any proof of the truth of the statements they made. The Prussian minister did not think a strong enough case had been made out to take any official notice of it or to make it worth while to bring the case to the notice of the American ambassador at Berlin.

Sahara a Forest.—French scientists and explorers have been discussing the question of reforestation of the Sahara and some of them entertain very hopeful views. M. Largeau thinks that the whole atmospheric conditions of the desert can be changed and universal cultivation made possible. Others, not so sanguine, despair of the more arid plateaus but state confidently that in the depressed portions trees, such as the tamarisk, acacia, eucalyptus and poplar can be grown with success. The poplar proves to be the tree of all others most capable of resisting the influence of the desert. Under the shelter of the trees all kinds of vegetables and fruits can be grown.

Extra Care for Improved Stock.

It should always be understood by those who purchase improved stock of any kind that it will need a continuation of extra care and feeding which has brought it to its present condition. Blood tells, but it is only when given good feed and care that it will fulfill expectations. Even the half-bred stock will not shift for themselves as the hardy native stock has learned to do. There should always

be sufficient food to keep the animal thrifty. It need not, and, with stock designed for breeding, should not, be fattening. But a thrifty-growing animal will always be in condition for killing if an accident such as breaking a leg, makes killing a necessity.

Trust Capitalization.—The following is the capitalization of a few of the leading trusts and combinations.

Sugar trust.....	\$ 75,000,000
Coal trust.....	85,000,000
Cottonseed-oil trust.....	20,000,000
Wall-paper trust.....	20,000,000
Lead trust.....	30,000,000
Rubber trust.....	50,000,000
Linseed-oil trust.....	18,000,000
Match trust.....	8,000,000
School-furniture trust.....	15,000,000
Type trust.....	6,000,000
Dressed Beef and Provision trust.....	100,000,000
Condensed Milk trust.....	15,000,000
Straw-board trust.....	6,000,000
Leather trust.....	125,000,000

The Size of a Poultry House.—The size of a poultry house will, of course, depend on the number of fowls it is designed to keep. Practical experience has shown that flocks of forty are large enough for best results. If a large number of fowls are to be kept it will be better to build two or more houses, and have them located at quite different points, so that each flock's ranging grounds will be as distinct as possible. The beginner should however, invariably commence with one flock, and branch out as he gets experience that will justify him in so doing.

The Russian Thistle which first made its appearance in this country about 1873 in Bonhomme County, South Dakota, has at last found its way east. Its presence was discovered by Wm. H. Van Sickel, supervising principal of the schools of western New York. He is of the opinion that the seeds had been carried east in a cattle car.

Sun, rain, rust and exposure wear out tools faster than the use of them

Well said; Drainage from a manure pile indicates a lack of drainage.

California Productions.—The following are the statistics of productions in the state during 1896. Gold, \$14,160,613; borax \$800,000; petroleum and bitumen over \$1,000,000, salt \$130,000; mineral waters, \$400,000; natural gas, \$150,000; quicksilver, 30,743 flasks; beet sugar, 46,000,000 pounds; wheat, 28,682,200 bushels; brandy distilled from grapes nearly 1,000,000 gallons; barley 10,800,000 bushels; beans 68,000,000 pounds; raisins, 84,000,000 pounds; dried fruit, 148,500,000 pounds; dried prunes 51,000,000 pounds; canned fruits, 1,340,000 cases; wool 24,500,000 pounds; hops, over 52,000 bales; oranges, 1896-97 estimated 8375 carloads; 1896, 2,512,500 boxes; butter, annual product, 48,000,000 pounds; cheese, 16,000,000 pounds; wine receipts at San Francisco, 12,914,670 gallons; brandy, 163,650 gallons; provisions, \$5,500,000; value of nuts, \$350,000; powder, 12,000,000 pounds; total gold product since 1848, \$1,368,429,278; quicksilver since 1877, 810,767 flasks; gold and silver since 1848, \$1,475,434,107.

Seventy-six thousand acres are set to orange trees and 70,000 to prunes; there are 3,900,000 acres of land under irrigation. There are 340,000 milch cows in the state and \$106,00,000 invested in dairies.

Nebraska Canals.—In Nebraska it is stated that there are completed 3,740 miles of canals, and that there are in process of construction 1,045.6 miles, making a total mileage at the present time of canals completed and in process of construction of 4,785.6. The estimated cost will exceed \$3,000,000, of which over one-half has already been expended. This will bring under irrigation 1,207,966 acres of land, increasing the value of the land nearly \$10,000,000. In addition to this there are applications on file for contemplated canals of a total mileage of 2,946.

The Fence that Turns Everything.

The fence made with the Duplex Automatic Woven Wire Fence Machine, which is made entirely of wood and malleable iron, and is so simple and easily operated that anyone who knows how to turn a grindstone can take it right into the field or any place and make 40 to 60 rods a day of the best

fence on earth, horse-high, bull-strong, pig, chicken or rabbit-tight at a cost for the wire of only 12 to 20 cents a rod. It can be made in a variety of styles or designs, using either plain or barb wire for the top and bottom margin wires, and by using wire pickets, weaving them right into the fabric ornamental designs can be made suitable not only for farm residences but also city and suburban residences. Messrs. Kitselman Bros., Ridgeville, Indiana, whose advertisement appears elsewhere in this issue, claim this Duplex Automatic Machine is the result of their ten years experience in the manufacture of woven wire fence machines and is perfection itself. Send for catalogue.

Bran Rather than Corn.—If food for stock has to be purchased it is best to buy that which will make the greatest return to the soil in manure. This means the purchase of bran, oats and linseed meal, and the growing at home of all the corn needed. We can grow corn with very little soil exhaustion, and the corn fodder is excellent to feed with the stronger foods that are purchased. Bran can nearly always be bought for but little more than its manurial value. It has been used as a manure without feeding. But that is wasteful, as it is excellent feed for both cows and horses.

No Car Fare

Tempe is undoubtedly the only place in the United States which operates a street car line that does not collect fares. The line is owned by the Goodwin Bros. and it has been in operation for about four years. It paid for itself for a couple of years and then the patrons got out of the habit of paying fare. The car still runs however, and at a dead loss to the owners, but they manage to keep it going for the accommodation of the public. The car has no regular driver of conductor, but anybody who wants to go to the other end of the city takes possession of the car and leaves it for some one else to bring back.

Protect the lambs against being drenched by sudden showers.

Never use the hands in working butter or in handling it.

A Consolidation of two Large Firms.

For many years our readers have been informed of the merits of the Hot Air Pumping Engine for supplying water. Two firms—The Rider Engine Co., of 37 Dey street and the DeLamator Iron Works, 467 West Broadway, New York City.—have made and sold thousands of these engines, and this consolidation means an enlargement of the facilities for producing the engines, as well as a cheapening of the cost. The successors of these two firms,—The Rider-Ericsson Engine Co.,—propose to give the benefits of this consolidation to their customers in the way of reduction of prices, as well as supplying an engine superior to those heretofore produced. These engines are simple in construction. They require no attention after a fire is started. Any kind of fuel can be used, and a very small quantity of heat will drive them to their utmost capacity. They are capable of supplying thousands of gallons of water per day, which on a farm or country residence can be distributed to any point with the proper piping, thus facilitating the watering of stock, sprinkling lawn, irrigating crops, and not only supplying water in every part of the house, barn, ect., but extinguish a fire if one should occur. A shallow stream or well, either dug driven or artesian, is all that is necessary for the water supply and the engine does the rest.

We commend this new firm to the best consideration of our readers. They are thoroughly reliable. After April 1st, 1897, the office of the consolidated firms will be at 22 Cortlandt street, and until that time all communications should be addressed to the Rider-Ericsson Engine Co., 467 West Broadway, New York, N. Y.

Gasoline Engines.

The Weber Gas & Gasoline Engine Co., of 426 S. W. Boulevard, Kansas City, Mo., is doing quite an extensive export business. Among recent foreign shipment of engines by this well-known firm are:

Two Weber Gasoline Hoisting Engines going into a mining country of Kaslo. B. C.; one large size gasoline engine to operate a machine shop at

Halifax, N. S. one complete electric light plant, including engine and fixtures. Merida, Yucatan; duplicate order for two engines for Piraeus, Greece; engines for mining, irrigation and for driving agricultural machinery have been recently shipped to Monterey, Guanajuato and Guadalajara, Mexico.

This company reports its trade as very satisfactory. It is just finishing the installation of a large amount of irrigation machinery for the Consolidated Canal Co., at Mesa, Ariz., Beyers Bros., of Sugden, I. T., the last named having a capacity of 4,000 gallons of water per minute; and the first named 7,500 gallons per minute.

Its 1896 design engine is meeting with great favor among operators of flour mills, mining machinery, electric light plants and other users of heavy and uniform power, ranging from 18 to 50 H. P.

Another of its specialties is a 4 H. P. Special agricultural engine which is designed particularly to meet the wants of farmers, ranchmen, feeders and others requiring a small power for grinding, pumping for small irrigation plants and pumping water for stock supplies.

Parties interested in Gas, Gasoline, Crude Oil or Distillate engines are requested to write the above company for copy of catalogue and testimonials.

Do You Want a Paying Buisness

That is safe and will be permanent? If you have a pair of horses and from \$50 to \$500 capital, the F. C. Austin Mfg. Co., of Chicago, will be pleased to correspond with you as to the use of certain special road-grading and earth-moving machinery; also well-drilling machinery. To save correspondence, write plainly stating your situation fully and naming parties to whom you can refer.

A Small Community

Nestled among the fierce monarchies of Europe are several quiet little republics that enjoy the blessing of free government. The republic of St. Martin has 8,000 inhabitants; Andorra 6,000; Mor-esnet, the smallest of all, on the frontier between Germany and Belgium, 1,200 inhabitants who carry on important industries.

PULSE OF THE IRRIGATION INDUSTRY.

MORMON COLONY LIFE.

BY JOEL SHOMAKER.

THE Mormons, inhabiting Utah and the west possess many peculiar traits of character, among the most noticeable are those of colonial customs. No colony founded by those people ever fails or becomes disorganized. The men and women are called by church authorities to settle upon arid lands and reclaim and always respond to the dictatorial mandates of their authorities. Scores of beautiful little cities now adorn spots in Utah that a few years ago were not regarded as fit for the habitation of Indians. The deserts have been conquered by irrigation and luxuriant vegetation covers the earth where once not even sage brush could grow.

A spirit of co-operation prevails among the mormons to a greater extent than with any other class of colonists in the west. The organization is such that an officer presides over five lay members and counsels from superior officials as to the best policy to pursue in all matter. Colonies are organized primarily for the advancement of church interests which depends of course upon the individual success of the colonists. The irrigation canals necessary for all colonies in the West are constructed by co-operation of those interested. The products of the farm are sold and machinery purchased through the same principle of co-operation.

Utah is composed of numerable towns where citizens reside. The farm are situated around the little colonies. Some farmers travel five miles morning and evening going to and from work. No fencing is to be seen except surrounding a few pasture fields. The co-operation plan of colonies secures the safety of the farm and prevents damage from roving animals. One man is as much interested as another in the growing crops, the ripened grain and the harvested stacks. The entire colony cares for the property of each other and individual prosperity thereby insures colonial happiness.

Colony life among the Mormons in-

creases the social and moral obligations so as to make the people better. The spirit of competition is more strongly enforced in colony life. Men and women compete for honors in superiority of demeanor, dress, education and refinement. The desire for individual wealth is not diminished in colonial organizations. Every family desires a home and as a result of their teaching over ninety per cent of the Mormon families own their homes. The consumers of commodities are more thoroughly trained and the tastes more completely modernized by a systematic colonial administration.

The Mormons have demonstrated that colony life is conducive to healthfulness. A better sanitary condition prevails among colonists and diseases are more readily controlled. Health brings wealth and wealth insures the comforts of life. Colonial schools are better disciplined, more thorough in system and more comprehensive in education. The luxuries of life in food, dress and recreation are more generally enjoyed and easier obtained under colonial jurisdiction. Many lessons have been learned from the Mormon colonies and the entire west seems to be adopting more or less of the information. With all their faults the Mormons have made rapid progress in the development of Arid America and their success can be attributed to the plan adopted for the guidance of colonies.

LAND AND CANALS IN WASHINGTON.

There are in the state of Washington 206,458 acres of land under irrigation and a total of 807 miles of ditches. The greatest number of acres in any one section is 139,410 in Yakima county, and the next greatest is 40,000 in Kittitas county. Following these the third and fourth highest in the list are Walla Walla and Okanogan counties, the former with 10,498 acres and the latter with 10,000 acres. As regards the expense of putting in these ditches, shown by the miles of ditches, Yakima county comes

first with 420 miles, and Okanogan second with 120 miles.

The known ditches in the state are as follows:

Counties.	Acres Irrigated.	Miles of Ditches.
Adams.....	900	10
Asotin.....	500	15
Douglas.....	4,700	60
Franklin.....	20	..
Kittitas.....	40,000	95
Okanogan.....	10,000	120
Pierce.....	250	..
Walla Walla.....	10,498	87
Yakima.....	139,410	420
Totals.....	206,458	807

The arid regions are all embraced in the counties of Yakima, Kittitas, Franklin, Adams and the lower half of Douglas, and contain 8,098,360 acres, as follows:

Yakima county.....	3,547,800
Kittitas county.....	1,095,130
Franklin county.....	785,500
Adams county.....	1,220,000
Douglas county (lower half).....	1,449,930

All of this section classed as "arid lands" should not be so included, for in the counties named, while arid in the main, there are fertile spots that are highly successful in horticulture and agriculture without water. The estimate of actual arid lands in the state has been put at from 3,000,000 to 3,500,000 acres, of which fully one-half can be irrigated profitably, while with the increase in land values it will be found profitable to irrigate an additional million of acres. The remaining arid lands, on account of their location on hills, or alkali or gravelly soil, will remain untouched.

In Yakima county there are completed or projected canals on which surveys have been run. There are 383 miles completed, 286 uncompleted, 141,410 acres reclaimed under the ditch lines, 69,910 acres under cultivation and over 60,000 acres for sale. This includes seven artesian wells at the Moxee farm, which vary in depth from 300 to 1000 feet, delivering eight cubic feet of water per second of time and covering 1250 acres of land, of which 550 are cultivated and the balance in the market. One of these artesian wells flows 1,000,000 gallons of water every 24 hours.

It is estimated that there are in Kittitas county about 40,000 acres under constructed ditches and in cultivation, in addition to which there are about 100,000 acres which can be irrigated by canals, some of which have been partly constructed, and their feasibility demonstrated.

The most extensive irrigation enterprise in the Yakima valley, and in the entire state at this time, is what is locally known as the high line canal. The survey of this canal was undertaken a short time ago jointly by the state and the Northern Pacific Railway Company within the limits of whose land grant it is located, and after a careful survey and examination its construction was found entirely practicable at low cost. This canal has its source of supply in the Natchez river, an important tributary of the Yakima, and its total length from the Natchez river to the Columbia river is 114 miles. It commands an area of about 400,000 acres, of which it is estimated that 285,000 acres are of first class quality. The state under the provisions of the Carey law, has selected 85,000 acres of this land, and as the Northern Pacific Railway Company owns nearly one-half of the total amount, these two large ownerships insure the early construction of this important enterprise.

Growth of Southern Manufactures.

In 1880 the South had \$257,244,561 invested in manufacturing; by 1890 this had increased to \$659,008,817, a gain of 156 per cent., while the gain in the entire country was 120.76 per cent. The value of the manufactured products of the South rose from \$457,454,777 in 1880 to \$917,589,045, in 1890 a gain of 100 per cent, against an increase of only 69.27 per cent in the whole country. The factory hands of the South received \$75,917,471 in wages in 1880 and in 1890 \$222,118,505. Since 1890 the gain has been very large, and the South is now turning out \$1,200,000,000 of manufactured products a year.

Get your hay in the barn or stack before the dew falls.

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Excursions at low rates run from St. Louis, Mo., Cairo, Ill., and intermediate points as well as other points in the north, on several days in each month. Tickets allow stop-over at any point South of and including Cairo, Ill. Low one-way rates also, for settlers and household goods and stock.

For information as to tickets, rates, etc, apply to Chas. Rudolph, D.P.A., Room 329 Marquette Bldg., Chicago, Ill. M.H. Bohrer, D.P.A., No. 135 Griswold St., Detroit, Mich. W. H. Harrison Jr., D.P.A., No. 220 Fourth St., Des Moines, Ia. F. L. Harris, Passenger Agent, No. 10 Sixth St., Cairo, Ill. W. B. Rowland, Gen. Agent, 215 N. Fourth St., St. Louis, Mo. E. E. Posey, General Passenger Agent, Mobile, Ala.

Horns On or Off.

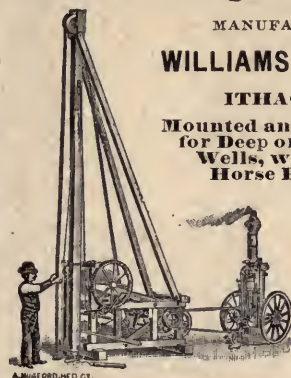
There was a time, many years ago, when a mulley or polled animal, one without horns, was something of a curiosity. More recently, by almost common consent, the people have demanded that for reasons of profit and humanity, both to man and among the animals themselves, there should be more mulies and the practice of dehorning sprung into popular favor. While the operation in itself seems a little severe it is certainly no more so than is the drawing of a tooth, to which we all submit willingly, because it subserves our best interests. In the selection of an instrument for dehorning, that one which will remove the horn quickest, cutting clean and not crushing the horn, must occasion the least pain and therefore be the most humane and best. These are among the claims made for the Keystone Dehorning Clipper, by its inventor and maker, Mr. A. C. Brosius, of Cochranville, Pa., writes to the gentleman, who will send you circulars, testimonials, etc., which will help you to reason this matter out to your entire satisfaction and profit.

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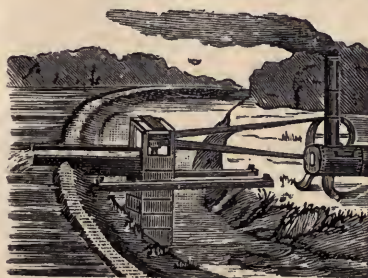
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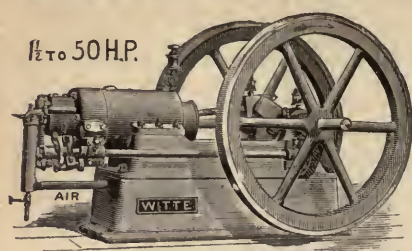
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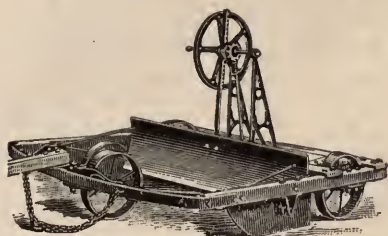
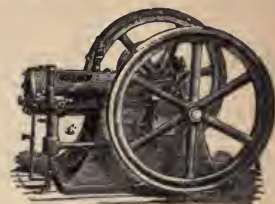
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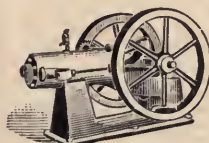
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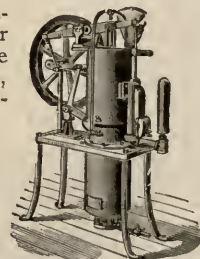
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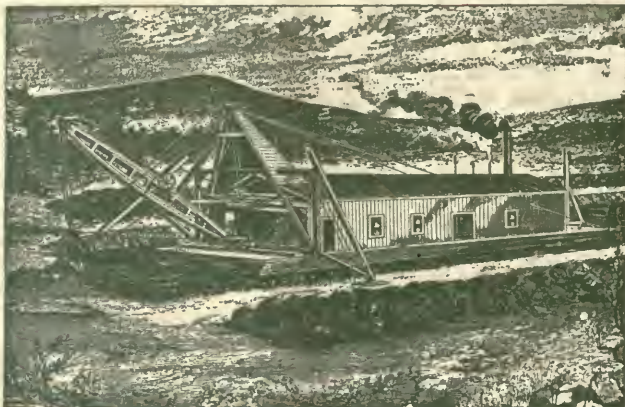
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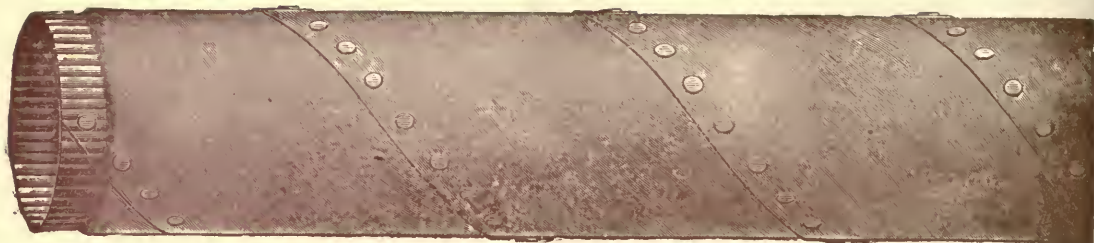
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The design must be one that can readily be reproduced or engraved for use on stationery or printed matter. Wording not to exceed twenty letters will be allowed.

Finished drawings not necessary; a rough sketch clearly portraying an idea will be considered and a completed drawing by an artist made therefrom if awarded the prize.

Make sketches on plain paper or cardboard. Do not write your name on the sheet containing the sketch; make some distinctive mark on the back of the sketch and a duplicate of it upon a separate sheet containing your name and address. The names of the competitors will not be submitted to the judges until after the award is made.

The competition closes promptly at 12 o'clock noon, July 1st, 1897. No designs received after that time will be considered. The award will be made as soon thereafter as possible and the name of the winner announced and the money paid August 1st.

It is expressly understood and agreed and made a part of this competition that the person whose design is awarded the prize renounces all title to the property which will be copyrighted in the name of the publisher of THE IRRIGATION AGE.

All sketches except the one awarded the prize will be returned to competitors if so requested and postage enclosed to cover same.

This competition open only to regular paid in advance subscribers to THE IRRIGATION AGE.

Mail the sketch and letter or sheet containing your address to

THE PRIZE EDITOR,
THE IRRIGATION AGE

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MENTION THE IRRIGATION AGE.

The Pecos Valley of New Mexico.

The part of the Pecos Valley which The Pecos Irrigation and Improvement Company has undertaken to reclaim by irrigation, is situated in southeastern New Mexico, extending into northwestern Texas, and comprises a large area of as highly productive agricultural and horticultural land as can be found on the American continent. At intervals along the Pecos River, for a distance of 165 miles, have been constructed dams, reservoirs and canals, furnishing an abundant and unfailing supply of water for 400,000 acres, over one-half of which area is already covered by the canals. The reservoirs have a total capacity of 6,300-000,000 cubic feet of water; the canals, with the main and sublaterals, have a total length of 1,500 miles. About 75,000 acres are already in the hands of settlers, of which over 2,000 acres are in actual cultivation, 2,500 acres being in orchards and vineyards. To further develop this region, a standard gauge railway, 164 miles long, has been built through the entire length of the Valley. Towns and villages have been started, of which Eddy and Roswell are the largest, the former having about 2,500, and the latter about 2,000 inhabitants. Hagerman, Otis, Florence, Francis and Malago are also growing villages. This work was undertaken a little over seven years ago, and has already cost over four millions of dollars. The Pecos Valley now ranks as the largest irrigation enterprise in America, and one of the largest in the world.



A THREE-YEAR-OLD APPLE TREE IN THE PECOS VALLEY.

Soil, Climate and Productions.

The soil of the Pecos Valley is, in the main, a sandy loam, and is of remarkable depth and richness. The climate is warm and sunny, practically winterless, with long growing seasons, and likewise possesses wonderful health-giving and restoring properties, especially for pulmonary and many other chronic diseases. This soil and climate, with the abundant water supply unite to produce bountiful crops of all the grains, grasses, berries, vegetables and fruits of the temperate zone. Such forage crops as alfalfa, sorghum, Indian and Egyptian corn grow most luxuriantly, making the feeding of cattle, sheep and hogs a most profitable industry. The sugar beet attains a perfection not reached elsewhere in the United States,

if in the world. A beet sugar factory, with a daily capacity of 225 tons of beets, is being built at Eddy and will be in operation November 1, 1896. To supply this factory the farmers of the Valley are now putting in fully 2,500 acres of beets, for which the sugar factory has contracted to pay \$4 per ton delivered at any station on the Pecos Valley Railway, the company paying the freight to the factory. At this price, and with the large yield per acre in the Pecos Valley, the farmer should clear all the way from \$35 to \$75 per acre from his crop of beets.

In the raising of fruits the Pecos Valley will take its place among the most highly favored sections of our land. All the standard fruits of the temperate zone are successfully raised, while several of these attain a perfection rarely equaled and nowhere surpassed. At the head stand the apple and pear, closely followed by the peach, grape, nectarine, apricot, plum, prune and quince. All the small fruits grow in abundance. The fruits of the Pecos Valley are without blemish, superb in form and coloring, and of unequaled flavor. In a few years they will be found in all the great markets of the country, commanding topmost prices because of their beauty and perfection.

Social and Educational.

The Pecos Valley is being settled in the main by progressive and intelligent people, the majority being Americans, mainly from the Central West. As a result, schools and churches are found in every town and village in the Valley.

The Pecos Valley, while attracting the general farmer and fruit-grower, holds especial attractions for those whose health requires an outdoor life in the dry, elevated region of the Rocky Mountain plateau; and these will there find not only the health they seek, but profitable occupation as well. Not only does this life appeal to the health-seeker, but also to the thousands all over our land, and especially in our large cities, who wish to exchange the life of grind and drudgery and marrowing industrial conditions, for one of independence and a larger hope for the future.

For prices of land, and terms, with copies of illustrated publications, address The Pecos Irrigation & Improvement Co., Eddy, New Mexico.

THE IRRIGATION AGE.

VOL. XI.

CHICAGO, MARCH, 1897.

NO. 3

THE PROGRESS OF WESTERN AMERICA.

President Cleveland's Forest Reservation. The success of forest preservation depends upon the intelligent and judicious selection of the reservations and the proper care of them thereafter. A reservation embracing grazing and agricultural lands cannot rightfully be called "forest preservation" and timber lands exposed to the ax of the lumberman and the destruction caused by the spread of the camp fires of careless tourists and hunters will not remain "preserved" for any length of time. Forest preservation in its true sense means the setting aside of timbered areas embracing the head waters of streams where the winter's supply of moisture is stored, to be drawn upon during dry seasons, and it also means the guarding and protection of such areas when reserved. President Cleveland's reservation proclamation of February 22, has been the subject of much unfavorable comment and harsh criticism. The thirteen reservations thus made include lands in South Dakota, Montana, Wyoming, Idaho, Washington, Utah and California, aggregating an area of over 21,000,000 acres. The boundaries of these reservations were marked by a special forestry commission supposed to be composed of capable men whose duty it was to personally visit the sections to be reserved. This commission has been publicly accused of wilful and flagrant neglect of duty. This has

been given special prominence in connection with the Wyoming reservations where it is charged the commission purposely avoided inspection of the timbered areas, spending the time in a pleasant visit to the Yellowstone National Park, and ignoring the requests of the state officials to make a full and complete investigation, although every facility for doing so was tendered them free of expense. It has been claimed that the opposition to the reservations was instigated by the lumber interests seeking the privilege of free timber, but an examination of the selection in the Big Horn mountains reveals the fact that the two townships in which the lumber camps were pitched were accidentally (?) or purposely overlooked, although the reservation extended on three sides of them. Moreover, these two townships contain the largest and heaviest growth of timber. The Teton Forest (?) reservation consists principally of agricultural lands upon which settlers are located and some mountains practically barren of timber. Just what the conditions in the other states are is unknown as no complete surveys have been made.

A Survey Required. As soon as the facts were made public by persons conversant with the particulars sentiment was aroused and an effort made to have the proclamations revoked. This created in the minds of some mis-

informed people the impression that an attempt was being made to curtail and limit the preservation of the forests. Such was not the case as many of those who were most earnest in their efforts for revocation and a survey are the acknowledged leaders of the forestry movement. It is true that some selfish interests took advantage of this to discredit the work and in some cases the newspapers voiced the contention that a million people would be deprived of homes. Such statements were absurd, and were not given credence among people familiar with the subject. At the present time the matter is awaiting the decision of President McKinley. He has patiently listened to the arguments for and against of the delegations that have visited him and it is trusted that he will see his way clearly through the intricacies and act in a manner calculated to conserve the best interests of the west. A great deal of credit is due Gov. W. A. Richards and State Engineer Elwood Mead, of Wyoming, for the active, intelligent and public spirited work they have done in attracting general attention to the true inwardness of the case, at least so far as relates to their particular state.

Irrigation Securities. The time is coming when irrigation securities will again become an important factor in the financial world. For several years they have been regarded distrustfully by investors and the reason therefor is plain; it can be condensed into one word—speculation. But the era of irrigation gambling has nearly passed. No longer is it possible to capitalize the future with glittering promises of immense profits. What the true friends of irrigation now most desire is a thorough comprehension of irrigation as it is and not as too vivid imaginations have painted it. When the capitalist can be brought to the point of understanding that irrigation is an industry susceptible of being profitably developed by the same legitimate, practical, economical methods that bring forth success in other lines of business enterprise, (and this has been and can be demonstrated beyond the shadow of a doubt) the money will be forthcoming to carry to completion the systems already begun

and to inaugurate others. Ample security and a reasonable interest on the investment is what capital desires. Such a security is the bond of the irrigation district, provided the district has been regularly organized, is ably officered and the system has been approved by an efficient engineer. Such a bond being a first lien upon the land and improvements as well as the water system, guaranteed by the faith of the people and redeemable by direct taxation is safe, if it is further provided that the total amount of bonds issued represents not more than a reasonable per cent of the value of the land irrigated. It is not the writer's intention to be understood as meaning that the bonds of all irrigation districts can be classed as good securities, far from it, but there are districts whose bonds are worthy of investigation. The bonds of the irrigation district will eventually be considered as good if not a better investment than those of municipal water works.

Trans-Mississippi Exposition Assured The last legal obstacle before the Trans-Mississippi Exposition has been removed by the passage through the Nebraska Legislature of a bill authorizing the exposition and making an appropriation for the same; and the bill has been promptly signed by Governor Silas A. Holcomb. The agitation in favor of this exposition was begun about a year ago by the editor of the Omaha Bee, and it was promptly followed by the organization of the citizens of Omaha, and the appointment of committees to take up the active work. So diligently and faithfully have these committees labored that they have secured subscriptions for the stock of the exposition company to the extent of several hundred thousand dollars, and have also induced the legislatures of some of the western states to make appropriations for exhibits. The well known ability and integrity of the men now in charge of the exposition assures it a successful outcome.

Irrigation's Opportunity The Trans-Mississippi Exposition presents to the irrigation industry an opportunity for display which it has not had since the World's Fair, and in fact, it is an opportunity of even greater im-

portance, as irrigation was not understood or appreciated four years ago to the extent that it is today, and even now it is far from occupying its rightful position in the public mind. The exposition opens the way for the conversion of many thousands who have been sceptical as to the results of water properly applied, and every portion of the Irrigation Empire should be adequately represented. Let the friends of irrigation cast aside sectional and personal differences and unite in a strong effort to place before the world an exhibit that will do justice to the progress of the industry.

Some Suggestions . . . With all due regard for the many branches of industry which will claim and occupy an important place at the exposition, it must not be forgotten that agriculture by irrigation is the foundation of all western development, and as such it should be given the position of prominence. A building devoted exclusively to irrigation, is of course a necessity, and no niggardly hand should dole out the funds to erect and equip it. While this is being done let the irrigation exhibits be prepared on a generous scale; first, the machinery for the earth and water handling: the dredgers, graders, scrapers, etc., for constructing canals and ditches; the cable-ways and appliances for building dams and headgates; the pumps, engines and windmills for lifting water; then the special machinery for cultivating the soil, and lastly, the finished product, the fruit and flower of field, garden and orchard.

A miniature model irrigation system with reservoir, canals and laterals, with headgates, flumes and wiers should be constructed, and it should cover a model farm, with a few square feet each allowed the various crops, showing in actual practice the details of furrow and check systems. Can you conceive of anything more attractive and convincing than such a display? It will bring forth good results.

Stimulate Home Consumption . . . One of the great problems before the producing communities of the west is the stimulation of home consumption. The wheat grower of Washington and the fruit raiser of

California alike, compete in the eastern markets, not only with the foreign products, but with the grain, fruit and vegetables grown in other sections of our own country, and the long and expensive freight haul across the Rocky Mountains and the Great Plains, takes away whatever advantage the west possesses in being able to produce greater quantity and better quality. Nearly every one of the western states are exporting products which should be consumed at home, but here is one of the peculiarities of this anomalous condition of affairs; fresh peaches are exported and canned peaches imported; live hogs exported and pork products imported. However, not considering the establishment of factories at this time, the thousand and one mining camps and country towns, are the natural markets for such articles as are produced in their neighborhood; but they are not properly cultivated. The consumption of fresh fruit and vegetables can be greatly stimulated, but if the farmer is content to dispose of his produce to a shipper who puts it on a car bound for a foreign market, he cannot reasonably expect to get a better price than it will bring in such a market in general competition, less transportation charges and shipper's profit. It should be a matter of pride with each community to increase the local consumption of home-grown products to the greatest extent, and then to see that the surplus is offered to consumers within the boundaries of their own state, wherever practicable, before being sent to outside markets.

The Problem of the Grazing Lands. . . . The supervision of the grazing lands is a subject but little understood, and one regarding which no comprehensive public policy has been inaugurated. These lands belong to the Federal government and they serve as a free range for cattle and sheep, without any provision for the protection of the grass which gives them their sole value, or for the protection of the small stock grower, who is often at the mercy of the larger one, or even for the protection of the residents and tax payers of a particular state, who frequently see their ranges overrun with foreign herds and it becomes a question of physical force

which shall remain. This condition of affairs is not conducive to the general development of the live stock industry. It has caused dissention and strife, the loss of stock and even human life. It has resulted in a large decrease in the number and value of the stock, and in some localities in the destruction of the grass, almost beyond recovery. It has been suggested that the leasing of the lands, under state supervision, at a rental of a few cents an acre would not only make the stockman secure in his pasturage, but would provide a fund for the carrying on of other public work. In order to do this, however, it would be necessary for congress to grant a certain area of the land to the states, either in perpetuity or for a term of years. The state officials would then assume control and the responsibility. Already some steps have been taken with a view to making a beginning on this line, and it should meet with popular approval. From the beginning of time the stockman and the farmer have been at war and this presents an opportunity for the settlement of some of their difficulties.

Important Decision A decision of far-reaching importance has been rendered by Judge Welborn, of the California Federal Court, by which it is held that the Government is entitled to the transportation of its soldiers, the mail, etc., at half the rates charged to the public, not only over the land grant but over all railways where it chooses to fix the rates for such service. It will make a difference of many millions a year to the receipts of the railway companies, but it is said they will submit to the decision without appeal.

Encourage Factories Westward If there is any one thing which the good friends of irrigation should believe in and work for it is the development of industrial enterprises. Encourage the factories to move westward. Induce them to locate near the raw material supply. It can be done. Manufacturers are ready to listen to propositions that may prove to their advantage, and what greater benefit can they desire than cheap power and the saving of excessive freight charges and be within reach of the raw material and

in touch with the consumer? All this and more can be and should be offered them. These factories will consume the products of the orchard, the farm and the ranch; they will employ labor and distribute money. The manufactured articles can profitably be sold at prices lower than now obtain, thus encouraging home consumption.

Immigration and Industrial Associations. Every western city and county should have its immigration and industrial association for the purpose of encouraging settlement and development. Its work should consist of gathering information about the resources of the state in general, and its own locality in particular; it should secure and maintain a permanent representative exhibit of products. It should enter into correspondence with homeseekers and manufacturers and spread before them the resources and advantages of its section. It should assist in placing upon the statute books wise laws that would encourage investment and protect both capital and labor. It should try to have the railroads grant additional facilities in train service, and sidings and stations whenever required and make reasonable concessions in freight and passenger rates. It should be composed of the most public spirited men in the community and no opportunity should be lost to arouse a strong and united sentiment in favor of, and a pride in local progress. THE IRRIGATION AGE will cheerfully lend its influence to such a movement and the editor would be pleased to correspond with those who would like take up the matter.

Beet Sugar Industry. The interest manifested in the development of the beet sugar industry is one of the most encouraging signs of the times. It has been demonstrated beyond doubt that sugar beets can be grown in every western state and territory, of course in some localities to better advantage than in others, but profitably in all. As shown in the February number of THE AGE the American production in 1896 amounted only to forty thousand tons, while the consumption was hundreds of thousands of tons. Millions of dollars were sent away for imported sugar, which should have remained in

our own country. The experiments made in growing the beet and in converting it into sugar prove that it would not be a difficult matter to produce the entire supply upon the irrigated farms of the west, and present developments indicate that it is merely a question of time before it will be accomplished. The next few years are destined to witness a most remarkable growth in this industry, which will be of the greatest benefit to the public at large. No effort should be spared to encourage the erection of sugar factories in the irrigated districts. Taxes should be remitted and local support should be unanimous and liberal. Let there be a generous rivalry for the establishment of several factories. It will pay.

The Flood Waters of the Large Rivers.

The recent floods on the Missouri and Ohio and Mississippi rivers have possessed a great and distinct educational value. They have brought the people at large to a realizing sense of the importance of storing the headquarters of these rivers and their tributaries. These tremendous floods of water carrying in their wake disaster, destruction and death, seem to grow more severe with every annual recurrence, but a remedy is at hand which will at least greatly decrease the damage they do, and possibly in time avert practically all danger. Heretofore the cry always has been for appropriations of vast sums of money to build and strengthen and enlarge the levees. This has been merely a make-shift. It is an attempt to build hundreds of miles of embankments strong enough to resist any flood, and naturally the flood conquers. It reminds one of our present naval conditions.—A certain manufacturer invents and builds a gun, the projectile from which will pierce any known armor plate, and the armor plate man immediately goes to work to make a plate that will resist the shot, and then the gun man produces a gun of even greater strength. And so the fight wages back and forth. They forget that the greatest resistance could be offered by simply plugging the gun. And so it is with the headwaters: If they are caught and stored before they gain headway and power on their jour-

ney of destruction their capacity for damage will be controlled and limited, and the wild, raging flood will be the most gentle of streams when turned into the irrigating ditch. It is encouraging to note that some of the great eastern daily newspapers understand the subject, as shown elsewhere in this issue by reprints, and now is the time for united demand from the flood sufferers and the drouth sufferers that the government take active steps in the matter.

Why Court Destruction.

To one who lived with- in sight of the Mississippi for years and saw the havoc it annually created it seems pertinent to ask why it is necessary or advisable to risk life and property by settling on the low lands, where in all human probability a flood will rage and destroy. Cheap lands you say! There are other lands just as cheap and just as good, which are not exposed to this danger. Surely in this great and wonderful country of ours there is room enough for you to live in peace and security, without unnecessarily exposing yourself, your family and your property to destruction. THE IRRIGATION AGE invites you to change your location.

Consideration for the Producer. The consideration of local consumption brings to mind the fact that there are certain localities in the irrigated west where the home market is already fully provided and that increased settlement and production have ceased, because there is no available foreign market. In some cases this is caused by a lack of direct transportation facilities, in others by excessive freight rates, and again because competition in the larger markets is too strong and the weak suffer first. This matter should be given earnest and thoughtful consideration by the managers of every land and water company, as well as by the traffic managers of the railroads. It is not enough to state in a glowing prospectus that nearby markets are waiting, and that transportation facilities are ample. This is one of the most serious questions relating to the development of the west, and upon its correct solution depends the development of thousands of acres already under the irrigation ditch, but *not occupied*. Why?

Mistaken Policy.

The London firm that is making a specialty of shipping California fruits to the English markets reports the first shipments of the year as entirely successful, although the fruit sent was not of the largest size or best quality. The shippers of such fruit are doing their state a grave injustice by sending any but the very best. Inferior fruit is a drug in any market this year, but good fruit commands fair prices and steady sale. At least until the market and the reputation of the goods has been fairly established there should be none but the best sent into new fields of consumption. When that has been done and the people have become accustomed to the possible high quality they will be able to discriminate as between qualities without condemning the whole product.

Disgraceful Business.

The California Fruit Exchange has been advised that Baltimore packers are intending to pack large quantities of peaches this year under California labels. It is said that large contracts for fruit so packed have been placed with dealers. Naturally California fruit growers are indignant. There ought to be a way, and there probably is, to punish such

frauds legally. It is not only infamous in itself, but is calculated to do irreparable injury to the reputation of California fruit which it has taken years to establish.

Traveling Dairy.

The Dominion government has decided to continue its support to this novel feature for assisting the dairy interests of British Columbia. Meetings are held in different localities where all who are engaged in the business may attend, and where the best methods are presented by discussion and practical illustration. The government is giving substantial encouragement to the starting of new creameries and effective assistance to those already in operation. This is an industry which ought to receive more attention from the irrigating farmer than it has heretofore. The facility which irrigation affords for intensive cultivation—for the production of the largest crops from a given area—allows compact settlement, makes forty acres or less equal to eighty, saves long carriage for the milk from farm to factory, and will give the largest return for intelligent management that is possible from the ordinary agricultural products.



A WINDMILL IRRIGATION PLANT.



RAMONA'S HOME IN SOUTHERN CALIFORNIA.

WATER DEVELOPMENT BY TUNNELLING.

BY JAMES T. TAYLOR.

The Ontario Tunnel, commonly known as the Bodenhammer Tunnel, is located on Mountain avenue, about one mile west of the famous Euclid avenue of the Ontario Colony lands, San Bernardino Co., California, and about $5\frac{1}{2}$ miles Northwesterly from the growing and prosperous city of Ontario.

The mouth of the tunnel is very near the San Bernardino Base line at an elevation of some 1700 feet above sea level, and commanding a large area of land which has been demonstrated to be first-class for the successful growth of citrus fruits.

Mountain avenue runs north and south and at right angles to the general slope of the upper portion of the valley or mesa, and has an average fall of about 206 feet per mile.

The object of the tunnel was to intercept the underflow from the mountain range known as "Sierra Madre", and divert the waters so developed by gravity into the present system for an increased

supply of the Ontario lands, and possibly other lands in the immediate vicinity.

Prior to the commencement of the tunnel proper, several shafts were sunk to a considerable depth, and tests of the water supply made by pumping.

These tests as reported seemed to indicate a considerable volume of water available, and to support in a measure the theory advanced by the promoters, and concurred in by the "water witch enthusiasts," that a stream of water exceeding a thousand inches was running to waste and only required tapping to secure and control the precious fluid.

The glowing accounts and reports of the hidden treasures, coupled with the growing necessity for a more ample supply of water for the Ontario lands, lead to the making of the contract by the San Antonio Water Co., on the part of the property owners, with Mr. Bodenhammer, et al., the promoters, for the development and delivery of a water

supply,—on a basis of \$500.00 per inch, measured at the mouth of a tunnel.—the S. A. W. Co. to furnish the capital, for the development, under the management of the promoters.

The tunnel is timbered throughout with 6"x6" redwood and 2"x6" redwood for lugging. The bottom width is 4 in the clear, and top width of 3½ feet, and 6 feet in height.

The bottom of the tunnel and the sides to a height of one foot are lined with concrete.

The total length of the tunnel is about a mile, and about a one-fourth mile more of the shafts along the line of tunnel.

Nothing of particular interest occurred in the cutting of the tunnel until the water strata was entered at the face of tunnel, causing a cave, and subsequently abandoning the further development in the main tunnel. Considerable water flowed into the tunnel for a time, until, about January 1st, 1896, it reach its normal flow, discharging at the mouth of the tunnel 4 miner's inches.

At this time the promoters of the enterprise decided to connect the tunnel with a shaft about 210 feet deep at a point about 20 feet back from the face, and run side drifts or tunnels into the water bearing strata above the main tunnel, first by pipes and afterward by shaft. Some four wells were driven before a connection was made, to be of any benefit in increasing the supply of water in the tunnel below. The first well was started with pipe 14 inches in diameter and reducing to 12, 10, 8 and 6. The second well was bored to a depth of 165 feet where some tools were lost and this well abandoned. Well No. 3. met with the same fate at about 175 feet, and well No. 4 was finally driven to the tunnel and a connection made. On cutting

the pipe at the water stratas, some considerable water was obtained for a time, diminishing, however until the normal flow was reached, which resulted in about 30 miner's inches. The pipe also filled with debris, and it was found necessary to excavate the shaft the full depth to allow the water to enter the tunnel.

The sinking of the shaft was a very tedious and expensive operation, as the several pipes had to be cut out in pieces as the work progressed.

The expense of the work, including tunnel and shafts, etc., has exceeded \$75,000 and the additional tunnel must be necessarily expensive.

In consequence of the existing conditions, and the enormous outlay with the result of the limited supply of water, sealed proposals were called for recently at Ontario, California, by the San Antonio Water company for the construction of certain proposed extension of the tunnel, resulting in the awarding of a small contract to the O'Neil Bros., of Cucamonga. Work is still progressing on the tunnel with some success in increasing the water supply.

This tunnel is one of the sources of water supply of the Model Colony of Ontario.

The total supply for the present season is now approximately as follows:

	Miners' inches.
San Antonio Creek.....	165
San Antonio Tunnel.....	81
Frankish & Staur Tunnel.....	18
Bodenhammer Tunnel.....	25

Making a total of 279

The effect of the light rainfall for the winter of 1895 is shown by the unusually small surface flow of the San Antonio Creek.



THE ART OF IRRIGATION.

CHAPTER XXI. A FEW FINAL REMARKS.

BY. T. S. VAN DYKE.

EARLY readers of *THE AGE* will remember that I was one of the strong supporters of the District system of irrigation under what is known as the Wright law in California. Time has proved that I was figuring on a finer quality of human nature than we have yet developed on this sphere. The position taken by *THE AGE* from the start that it is adapted to wild and unsettled sections was correct. So great had been the run of tenderfeet into many parts of California, ready to pay almost any price for a good bit of land, water, scenery and climate, that many of us fondly hoped some districts would be an exception to what was undoubtedly sound principle. But time has proved that the tenderfoot is not going to bite until he sees water on the land or very close to it. And this he cannot see until considerable money has been spent. And no one cares to put up that money until he sees where the income is to come from. In the meantime if any bonds are out the interest is running, the bonds depreciating and the land owners growing very weary. Little Rock District in California (not Big Rock) is a success with its bonds at par, interest all paid and everything working well. But it is a small district with no conflicting interests, every land owner signed the petition for the formation of the district, every one voted for the bonds, every one is not only able but willing to pay his taxes. With good land and a good water system it could not be otherwise than a success because it has all the conditions for a landowner's company without any Wright law. But where these conditions are and especially where the sole resource for paying the taxes is the sale of the land to new comers the system is a failure and always will be. The "suckers" can't run fast enough to keep the sellers ahead of the interest even if they should try to, and the great trouble is they will not try. The operation of the law has developed many

defects and it is now by its best friends admitted to be a practical failure in most cases with many and radical amendments. I cannot therefore recommend any one to buy in a district organized under such a law until amendments carefully made after a full study of its defects have been made and carefully tested. The system should be a success, and can be wherever a landowner's company can be and should be in many cases where the latter cannot. But too many objectors cannot be dragooned and too much wild land cannot be taken in. And there must be some resources for paying taxes besides the sale of the land or the profits from stuff to be planted after water comes. Any section that disregards the experience of California with this law and thinks it can easily amend it, is liable to get in trouble and when it does it will be in trouble such as few have ever dreamed of. The consequences of a mistake are very, very, serious.

Every man thinks he can irrigate. But no one man ever worked out the problem. Its solution is the result of combined effort reaching over years of time, with constant comparison of notes and study of errors. While nothing is simpler when one understands it, nothing is more certain to perplex the beginner. Many a good colony proposition has been "hoodooed" out of several years growth by allowing tyros to riot with the water as they surely will. Especially is this the case on desert soil that for ages has not been thoroughly wet to the subsoil. It is impossible to make them believe that that soil may need irrigating several times before anything should be planted in it, that you cannot wet it down enough with one irrigation, that it is not so level as to need no grading, and many other points. I am myself interested in a fine proposition of this kind which is now hung up high and dry by the obstinacy of associates, wise in other respects, but who would not believe me

when I told them to allow no one to touch the land with water unless it was first graded and to allow nothing planted in it until it was wet at least twelve feet below the top. No colony projectors can afford to ignore these and many other principles and the first settlers should not be allowed to touch the soil except under the eye of some one who knows how to do it. For whatever is wrong will surely be charged up against land or climate and generally both and "hoodooed" it may take years to overcome it.

Irrigation is one of the things that can be learned almost entirely from a book. It requires no training of the muscles and almost none of the eye. It depends upon certain principles and when you once learn them you can hardly fail in the details. It is like directions for following a road into a new country, consisting almost entirely of warnings. When you heed them your feet will do the rest. When you have studied these principles thoroughly you will find irrigation by far the most satisfactory way of working the soil, and considering the difference in the value of the product, much the cheapest.

We are entering the era of irrigation. Not only in the west but in the east it is going to make farming once more respectable and popular by making it profitable, convenient and certain. Only in this way can we relieve the cities of the congestion that is the danger of the republic. You may talk more money as you will, but we do not know that it will raise the price of the farmer's products against the competition of the whole world. But we know that irrigation will increase production in spite of all the cheap labor in the world. And we know that without it production has about reached its limit, east, west, north and south. Fertilizers can do little more without water and with water there will be little need of fertilizers for many products, because irrigating water is often a fertilizer itself, and any water enables plant roots to decompose the coarser parts of any soil. Lands that are too dry cannot be restored with mere fertilizers and most all the land left for the settler in America is of that class. Semi-arid land will be a curse rather than a blessing to the hopeful man who leaves

the town and will only spread wider the idea that there is nothing in farming.

Our ancestors came from the rainy lands of Europe and settled on the rainy side of America. They have done nobly, but the rainfall is their limit. The last acre available for the increase of our country's wealth on the rainfall alone is about gone. On the rainfall alone who dare say that the future of our country will be an improvement on the present? And who dare say that with irrigation it will not? With irrigation, division and subdivision are the rule. Without it bulging out one's neighbor and throwing the two farms into one is too often the rule.

Felling a forest and digging out the stump or awaiting their slow decay, to see a crop drowned this year with too much rain, the next dried out with too much sun is the modern way of cultivating the soil. Finding land ready for the plow and leading out upon it streams that flow from perpetual snow so as to have water and sunshine always on tap was the first and by far the better way. The cradle of civilization was rocked beside the irrigating ditch, and there architecture, sculpture, poetry and letters reached their highest development, flourishing for ages before the axe preceeded the plow in any part of the world. For centuries the conquerers, statesmen, philosophers, artists, writers and teachers of the world were born only in the lands where water and sunshine were both under control. Those in which dependence was directly on the fickle clouds produced only the savage and the viking. Irrigation in the past has supported the largest populations of the world. Even today the unirrigated portions can nowhere compare with the irrigated sections in the value and amount of produce to the acre, in the number of persons to the square mile living in comfort and even luxury, and the solidity and refinements of the settlements which resemble more the suburban residence parts of large cities than farming communities.

It is not rash to say that some of us may yet see the future millionaire endow some mighty waterworks first and leave the future income to the college which is less needed than the water. It is easy to be generous on other's money,

but I would rather leave my name attached to some great reservoir like that on the Gila or Salt River above Phoenix which cannot now be built because immediate returns on the outlay are not certain, than leave it to be fought over by nephews or cousins who for years have been praying for my translation to a better—or rather another—world. In time colleges, churches and hospitals can be built and heirs also be made happy out of the income. In the meantime let our dear cousins earn a living from the soil below it and gain a good stomach to digest the good fare in which they will riot when they finger the income from our earned gold.

RECENT FLOODS.

In connection with the recent damaging floods on the Mississippi, Missouri and Ohio it is an encouraging sign to note that the large daily papers have begun to realize the importance of irrigation.

Philadelphia Record: If its surplus waters could be diverted and stored for irrigating purposes what a blessing it would be to the millions who dwell upon the plains and to the millions upon millions who will people them as time rolls on! The Mississippi is big and so is the future, and so is the mind of little man, and there is no telling what may be achieved in the matter of utilizing the now destructive and terrifying flood.

Chicago Times-Herald: The simplest of all plans, which has already been outlined in the Times-Herald, is the adoption of irrigation in northern farming, or in those states whose waters are tributary to the Ohio and Mississippi. It would accomplish two great results. It would make farming more profitable, and it would prevent the disastrous floods. Waters stored on northern farms for use in midsummer cannot devastate the low countries to the southward while our farmers would never suffer from a season of drouth.

A LARGE CORPORATION.

In a recent number of Current Literature an English writer asserts that "the greatest corporation on earth is the London and Northwestern railway company of England, with its capital of \$595,000,000, a revenue of \$6,500 an hour, 2,300 engines and 60,000 employes and repairs that cost \$130,000 a month."

"Everything is made by the company," says this writer, "bridges, engines, rails, carriages, wagons and innumerable lot of other things even the coal scuttles and the wooden limbs for the injured of the staff."

The Northwestern railway company is no doubt a gigantic corporation for a little country like England and worth bragging about, but we have got a bigger one here in the United States that might absorb it very easily. The Pennsylvania railroad, for example, has a capital of \$857,075,600 and 15,430 miles of track, which traverses thirteen states. It has 3,756 locomotives, which consume 10,000 tons of coal a day and make runs equal to the distance around the globe every two hours. It has 3,935 passenger cars, 154,000 freight cars, 350 Pullman cars and 241 other cars for construction and other purposes, making a total of 158,524 cars, which make a journey equal to the circumference of the earth in every eight minutes. These locomotives and cars, if placed upon a single track, would reach from New York to Chicago, or ten times the distance between Philadelphia and New York. The rails of the Pennsylvania Railroad, if laid end to end, would encircle the globe and overlap about 4,000 miles. The total annual revenue of the road is \$135,000,000—equal to \$372,506 a day, and \$15,525 every hour of the day and night—which is two and a half times as much as that of the Northwestern of England.

THE DIVERSIFIED FARM.

In Diversified Farming by Irrigation lies the Salvation of Agriculture.

THE AGE wants to brighten the pages of its Diversified Farm department and with this purpose in view it requests its readers everywhere to send in photographs and pictures of fields, orchards and farm homes; prize-taking horses, cattle, sheep or hogs. Also sketches or plans for convenient and commodious barns, hen houses, corncribs, etc. Sketches of labor-saving devices, such as ditch cleaners and watering troughs. A good illustration of a wind-mill irrigation plant is always interesting. Will you help us improve the appearance of THE AGE?

THE THREATENED EUROPEAN BOYCOTT.

The best thing that could happen to this country would be to have carried out the threat of a Paris newspaper—an economic and industrial alliance by European nations against the United States. Probably the festive Frenchman who made the threat has never carefully studied our list of imports from European countries in comparison with a list of products *in esse and in passe* in the various States of the Union. With copper from Brazil and tea from Japan, China and a few other things purchased wholly outside of Europe, we should get along very well, and in six months wouldn't feel the change. In this connection it should be recalled that our total foreign commerce is but about four per cent of the entire commerce of the country. That is to say ninety-six per cent is internal commerce and only four per cent, external trade. Therefore, come ahead gentlemen. Don't hesitate a moment about forming your European commercial alliance to boycott the United States!

WASHINGTON FOR SUGAR BEETS.

And now Washington is claiming to be the banner sugar beet state.

Prof. Elton Fulmer of Pullman in a recent bulletin from the experiment station writes as follows: In order to determine the adaptability of the various sections of the State, seed was distributed and samples were tested from ten different sections of the State. The experiments were made in a large way—in fact, we may say practically on industrial lines. An acre of beets constituted each experimental field and fifty samples were

taken from each field to secure a fair average. Now for the results. As we said before, the poorest samples averaged above 12 per cent sugar, or to be more exact, throwing out one exceptional sample that was grown under peculiar conditions, we find the nine poorest samples averaged 12.31 per cent sugar in the beets, or to make a better comparison of sugar cane, of which the cane juice ordinarily is tested, the juice of the nine poorest samples averaged 12.96 per cent sucrose of 80.24 per cent purity. Now we shall consider the best ten samples, and with increasing experience it is certainly fair to think that the farmers of Washington will be able to raise beets equal to these best ten samples. The best ten samples averaged 20.31 per cent of sugar in the juice, the poorest of the ten indicating 18.3 per cent and the best of the ten 23.6 per cent sucrose. The purity of the best ten samples averaged 91.3 per. cent.

SUGAR VS. WHEAT.

There are indications that the American people are waking up to the possibilities before them in the manufacture of sugar from beets, but it will be a long while before there will be factories enough to supply the 2,110,000 tons consumed annually by the people of the United States, when it is remembered that the total production of beet sugar for the year of 1896 is estimated by good authority at only 40,000 tons, and 2,000,000 tons of sugar will require to be imported for home consumption. On the estimate of 12 tons of beets per acre, average, or 14,000 pounds, this weight should yield at least one ton of pure sugar. Therefore, to produce 2,000,000 tons of sugar will require the pro-

duct of 2,000,000 acres of beets. Compare this with the raising of other crops, for instance wheat. For the past five years the average yield of wheat in the United States has not exceeded 12 bushels per acre. The average price to the farmer has not been more than 70 cents per bushel, or \$8.40 per acre. On this basis it requires the product of seven acres of wheat to pay for one acre of beets.

Is it a wise policy to export the product of 14,000,000 acres of wheat to pay for the product of 2,000,000 acres beets? This country has the labor, land, capital and skill to produce all the sugar we consume. To pay for the sugar we import is a constant drain upon the gold reserve. The sugar problem is one that deserves the earnest consideration of the incoming administration, and no doubt will receive it.—*L. A. Times.*

TWO METHODS OF TREE PLANTING.

During the past fifteen years I have planted a great many trees, both fruit and deciduous, and have lost but very few—not to exceed two per cent. I have always attributed my great success to the careful manner in which the trees are handled and planted. My aim is always to preserve as much of the roots as possible, trim off the ends that are lacerated, keep them damp all of the time, work the fine soil well among the fibrous roots, and firm the soil solidly on them, and finish by leaving the top layer of soil loose. The tops are trimmed to make a symmetrical tree. The foregoing is the regulation method among tree-planters. Now, I have a neighbor who plants a great number of trees, and whose success is even greater than mine, for he loses none to speak of, and his trees start off in good shape, and make a fine growth right from the start, yet he seems to be the most careless tree-planter I ever saw. His method of planting is rather peculiar, but his great success proves it to be good, while three years after planting his trees are better than mine.

He always buys two-year fruit trees, and deciduous, not over six feet in height. The roots are all cut back to six inches in length, and the top short-

ened and all branches cut back to two inch stubs. A hole a foot in diameter is dug, the tree jabbed in watered if necessary, fine soil filled in and packed tightly about the root stubs, and a couple of shovelfulls thrown loosely on top. I have seen him cut the roots of a large two-year old apple tree back to three inches, all the branches off smooth, and the top back to three feet, and in two years afterward he had as fine, thrifty and symmetrical trees as any one could wish for, and they were actually larger than the same sort of trees set with all the roots carefully preserved. Any person can readily see the advantages of such pruning and root cutting, labor saved in setting out, etc.; and as the method has proved such a grand success with him, there is no reason why others should not adopt it. All trees I set out hereafter will be treated in this manner. Fred Grundy in Ill. Farm and Fireside.

SWEET POTATOES FOR MARKET.

Col. S. S. Harvey, of Quinette, Escambia County, writes to a farm paper as follows:

As a matter of interest to many of your readers, allow me to call their attention to the market price of sweet potatoes at various Northern markets. While I am satisfied that the ordinary yams we have been in the habit of raising are a good paying crop, there is one variety of the sweet potato not raised generally in our section or state that at all times sells for considerably more than any other variety in all Northern markets; in fact, nearly double the price of other sweets. That is the "Jersey Sweet." Without doubt it is the "aristocrat" of sweet potatoes, as the pompano is of fish, as the Bartlett is of pears. It has a subtle flavor no other of its kind possesses.

But the important point is its selling qualities. It will produce in quality about the same as our best, and sell for at least seventy-five per cent more in any of the Northern markets. On the twentieth day of August last I dug a row and shipped them, in a carload of pears, to Chicago. There were five boxes of them (the ordinary pear-box), and they sold for six dollars and seventy-five cents.

That was about two dollars and twenty cents per bushel here, boxed.

It would pay at these prices, to give especial attention to early sweet potatoes and to Jersey Sweets. I know that many of our people are looking for a crop that will pay while their fruit-trees are growing, and I think here is a crop that will fill the want.

PEACH GROWERS TEN COMMANDMENTS.

One of the largest eastern peach growers, offers the following for the guidance of peach growers;

1. High, dry, sandy or sand-loam soil.
2. Careful selection of varieties most hardy in fruit bud.
3. Vigorous, healthy seeding stocks, budded from bearing trees of undoubted purity and health.
4. Trees given entire possession of the land from the start.
5. Thorough culture from the opening of spring till the first or middle of August.
6. Liberal annual manuring, broadcast, with commercial manures rich in potash and phosphoric acid, lacking in nitrogen.
7. Low heading and close annual pruning for the first five years.
8. Keep out most borers with some suitable wash, and dig out all others.
9. Search for traces of yellows every week of the growing season, and at first sign pull up and burn every infected tree.
10. Thin the fruit so that there shall never be what is termed a full crop.

And adds: "On these ten commandments hang most of the law and all the profits."

OUR EXPORT TRADE.

There was a considerable gain in the export of manufactured merchandise last year. Agricultural products made up about 60 per cent of our total exports in 1896, against 70 per cent in 1895, 72 per cent in 1894 and 74 per cent in 1883. That made an increase in absolute value from \$553,000,000 in 1895 to \$580,000,000 in 1896, and is accompanied by a falling off in percentage, due to the fact that the sales abroad of our manu-

factured products grew proportionately much faster—from \$184,000,000 in 1895 to \$228,000,000 in 1896. This gain was the result of the stimulus given to the export trade by the reciprocity arrangements negotiated under the last Republican administration, and it would have been much greater if they had not been revoked. The manufacturers believe that it can be made much greater year by year if the reciprocity arrangements could be renewed and extended to other nations upon a broad and just principle that will equalize trade.

The association already has a bill before congress for the establishment of a department of manufactures and commerce, with a cabinet minister at its head. The bill was reported favorably from the committee on commerce of the Senate, but there was no prospect of its passage at the last session. The effort to secure such legislation will be renewed at the next session. The manufacturers think they are entitled to equal consideration with the farmer, and that the export trade could be considerably promoted if there were some agency under the government looking out for it.

A Remedy for Burdocks.—The following letter to Secretary Coburn, from P. H. Wimpey, of Burlington, Kas., contains a good suggestion from experience and is here published. Doubtless the kerosene remedy will be found efficacious for other troublesome weeds as well as the docks. Mr. Wimpey says:

"Burdock is very common in this part of Kansas, and when it once gets a good start in yards and along fences it is very troublesome to get rid of. I have a remedy that perhaps is new to some. It is simple and not expensive. Any time after the weed begins to grow in the spring until fall, cut the stalks off at the top of the ground, make a hole in the top of the root and pour about a teaspoon or tablespoonful of kerosene in the opening, and it will rot from top to bottom of the root in a few days. It is a sure remedy and never fails in any kind of weather, and is much quicker than digging them out by the roots. The same remedy will apply to yellow dock. I generally use a screwdriver in making a small opening for the oil.

A Blessing in Disguise.—We hear but little now as to the spread of the Russian thistle. A recent writer has claimed it is a saline plant, which may be permanent near the sea-coast but which will not live long in the interior. It requires alkali to feed on and exhausts it from the soil very rapidly. It should therefore be ultimately beneficial to "alkali soils."

Fertilizer.—The South Carolina agricultural Experiment Station in a recent bulletin says:

The cotton farmer who sells a ton of cottonseed for \$7 sees as much fertility taken off the farm as a dairyman who sells twenty-five tons of butter for \$400 per ton; while the dairyman who buys a ton of cottonseed meal for his cows brings to the farm as much fertility as he will drive off in the shape of forty live hogs that will bring him \$400—and the manure of the hogs as well as that of the cows, will remain behind.

Western Wealth.—According to the census returns the per capita wealth of different groups of States is as follows:

North Atlantic States.....	\$1,231
South Atlantic States.....	479
North Central States.....	1,129
South Central States.....	569
Western States.....	2,250

The Western States, therefore, average nearly twice the wealth per capita of the northeastern and north Central States and nearly four times the wealth of the Southern States.

Do not go to Extremes.—The low price of potatoes last fall will naturally tend to a reduction of area to be planted this season. The chances are that many farmers may be over prudent in this respect. It is a standard crop, the consumption is always very great and ordinarily it pays the farmer as well as any. The cheapness of the tubers this year is tending to open new avenues of consumption, even for the manufacturing of Irish whisky in quite a large way.

Alfalfa.—If there is a failure to get a full stand of clover or alfalfa from insufficient seeding, or any other cause, let the first crop go to seed. Then when

the ground is in good condition run over it with a light harrow to beat the new seed out of the hull and to harrow it in at the same time.

Grangers and Farmers Clubs in many places are saving their members considerable in purchasing supplies through combinations that secure wholesale rates. It requires good business management and co-operative buying is more easily accomplished, and with better average results than co-operative selling, though the latter is becoming more general each succeeding year.

Farms and Farm Rentals in the United States.

By the census of 1890 the following is shown to have been the number and status of farms in the United States:

	1890	1880
Farms in United States.....	4,564,641	4,008,967
Farms rented for money	454,659	322,357
Farms rented on shares	840,254	702,244

This shows a slight increase in tenant farming during the decade, 1880 to 1890. In 1880 the tenant farmers occupied 25.56 per cent of the farm and in 1890 the percentage had risen to 28.37 per cent.

The Propagation of the Olive tree from cutting has made it possible to sell these trees from nursery at 10 to 12 cents instead of \$5 to \$10 a tree as formerly. A Pomona man was the first man to do it successfully, but has never derived advantage from his discovery.

No Danger From Irrigation.—The Greeley, Colorado, Tribune says, excluding nine accidental deaths and six from old age, the death rate for 1895 was less than one in a hundred of the population. It cites this as evidence that the popular idea that there is a great danger to health from the irrigation ditches is wholly without foundation.

The Best Fertilizer.—Strawberries introduced into Southern California recently are known as the ever bearing variety. The vines yield fruit every month in the year. Strawberry growers will do well to follow the example of New Jersey berry growers in the matter of fertilizing. The Jersey people use cow

manure only. This manure is piled several feet high and two feet wide. It is turned three times before being used. About ten tons per acre is put on the vines. This treatment causes the vines to yield a great crop.

Los Angeles Times.

Frosts in Italy.—The following dates of disastrous freezes among the orange groves of "sunny Italy" are given by an Italian journal. In 1789, 1794, 1811, 1820, 1829, 1837 and 1854. It is alleged that the best groves now to be found in the Rivera region are those which grew from the roots of the frozen trees of 1820..

French Import Apples.—France produces enormous quantities of apples yet imports large amounts each year. For example: The crop of 1893 was 8,576,645,517 pounds, and the imports were 10,445,802 pounds. In 1894 the imports rose to 13,716,083 pounds, according to Consul General Mors at Paris.

Wheat Consumption.—Five bushels of wheat per capita, are regarded by the best statisticians, as about the amount of that cereal consumed annually in the United States. Our population now is about 70,000,000, hence a wheat crop of 350,000,000 to 400,000,000 bushels is required for home consumption each year.

Dried Fruits are alleged to be gaining much favor as an article of diet throughout the Eastern States, and some of the grocery papers predict quite a boom in such goods in the near future.

Successful fruit culture may be described in four words according to Prof. Bailey: "Till, feed, prune, spray." This however, is but half the battle. The marketing comes next, and is really the feature of the industry. If four words could point to entire success in marketing fruits they would probably be these; "Cull mercilessly, pack carefully."

An Object Lesson to fruit growers is given in the following statement of Mr. G. A. Cochrane, of Massachusetts, a dealer in apples. He alleged that of fully

fifty growers from whom he received fruit for export only three culled it closely, and the result was that the fruit of these three careful packers brought twice as much per barrel as the rest.

Some Good Springs are found in Texas. A bulletin from the experiment station at College Station, Brazos County mentions the fact that the water from Lysle Springs has been used for 20 years to irrigate 3000 acres of land. The flow averages about 7,000 cubic feet per minute.

The Deepest Well in Texas is 3,300 feet, and the temperature of the water is 142 degrees, according to bulletin 35 from the Texas Experiment Station.

An Ohio Beet Sugar Factory.—Steps are being taken by Joseph S. McKell and other capitalists of Chillicothe, Ohio, for the organization of a company to operate a factory to manufacture beet sugar. Emmitt's old distillery, a mammoth plant which has stood idle for fifteen years, will be fitted up as a factory, if the deal goes through. At a meeting of the Board of Trade much interest was manifested in the proposition.

Tariff and Cattle.—It is claimed that the present tariff law has had the effect to lower the price of Texas and southwestern cattle at least \$2 per head, and that it is contributing in a marked degree to the growth of the cattle industry in Mexico.

Damage by Insects.—Prof. Fletcher, entomologist of Canada alleges that in 1891, out of an agricultural product in the United States of \$3,800,000,000 there was an actual loss by insects of \$380,000,000, or ten per cent of the whole.

Tobacco.—A San Diego (Cal.) rancher is producing three crops of tobacco from the same four acres of land—only possible under irrigation, even in a favorable climate and a long season.

The Pomona Brand of canned tomatoes to be had and will make an exceptionally large pack, of which a large proportion will be consumed at home.

JOHN GERALD GRIFFIN.

John Gerald Griffin, one of the earliest and foremost promoters of irrigation enterprises and well known throughout the entire western country died March 1, at his home at Wheaton, Ill. Mr. Griffin was at one time editor and pro-

favorably known to the manager of nearly every Western Union office in the western country.

He was among those who attended the recent irrigation congress at Phoenix, Ariz. His ability and sterling honesty were recognized by his business associates in Chicago and other cities and they



JOHN GERALD GRIFFIN.

prietor of the Spokane Globe. He was also at one time engaged in the grain business at St. Louis, and was for many years connected with the St. Louis daily press. He secured the position of solicitor with the time service department of the Western Union Telegraph Co., several years ago and was personally and

were grieved to hear of his premature demise. Messages of sympathy were received by F. W. Brainerd, Superintendent of the time service department, from representatives of the Western Union in San Francisco, Omaha, St. Louis, El Paso, Tex., Phoenix, Ariz., New York, Portland and other cities.

FOREST PRESERVATION.

Various organizations in the United States have been for some years making the effort to have the government adopt a national forestry policy for the preservation of the forests still remaining on the public lands. The total forest areas in the United States are estimated by the department of agriculture, at 495,000,000 acres, or about one quarter of the total area, exclusive of Alaska and the various Indian reservations.

The annual requirements of forest products in the country are approximately over 24,000,000,000 cubic feet made up as follows: Lumber market and manufactures, 5,000,000,000 cubic feet; railroad construction 600,000,000 cubic feet; charcoal, 250,000,000 cubic feet; fences, 500,000,000 cubic feet; fuel, 18,000,000,000 cubic feet, and mining timber, 150,000,000 cubic feet. At the present rate of cutting off the timber, the existing forest area cannot long supply the demand. Several states have taken steps for the preservation of their forest areas. New York created a forest commission in 1885, but it was abolished by the adoption of the new state constitution. California provided for a similar commission, but it was abolished in 1893, the forest experimental stations in the state being turned over to the state university. Colorado, North Dakota, Pennsylvania and New Hampshire have forest commissions. Minnesota and Wisconsin have each a forest fire warden. Ohio has a foresters bureau, Maine a forest commission, while New Jersey and South Carolina the state geological survey has charge of the preservation of the forests.

There is a national organization known as the American Forestry association, which meets annually, and there is a forestry division of the department of agriculture. Besides all these agencies for the preservation of our forests, arbor days to encourage tree planting, are observed in forty-four states and territories; in twenty-one of them by legislative enactment; in six as legal holidays and in five as holidays for the public schools. There has been a united effort to have the national government at least second the work of the states and organizations

and preserve the forest areas in the public domain at the west. In 1891 an act was passed under which the president was authorized to make public forest reservations and under that law seventeen such have been established, embracing 17,500,000 acres in Colorado, New Mexico, California, Arizona, Wyoming, Oregon and Washington. A bill to provide for a systematic forest administration passed both houses of the LIId Congress, but failed to become a law. The same or a similar law passed the house in 1896 but went no further.

Hershey, Nebraska—The following were the carload shipments from Hershey, Nebraska for the year 1896: Hay, 214; wheat, 19; corn, 18; live stock, 16; potatoes 8; oats 7; broom corn 3; miscellaneous 4; total 289. This shows a car a day for each working day in the year. Where is there a newly opened territory in the state that can show such a diversity of agricultural products? This valley is bounded on the north and south by branches of the Platte river with irrigating ditches in operation that carry water to every quarter section of land, which can be made to raise without any possible change of failure a full crop every year, giving farmers and stock raisers full value for the time and money expended. Farther back in the foothills are the herds of cattle that consume a part of the corn; nearby mills use a larger part of the wheat, while the shipments show how much of a surplus was sent away the first year the irrigating ditches were completed and in operation. The town of Hershey has two general stores, one hardware store, a lumber yard, a coal yard, a first-class elevator, blacksmith shop, wagon and buggy shop, building contractor, and other enterprises.

Colorado.

Artesian wells are proving exceptionally successful at Rocky Ford, Colorado. It appears to be an artesian basin in which the water is delivered under very high pressure.

Montana Engineers.

The Montana Society of Engineers holds regular monthly meetings and is doing a great deal to build up a high

standard among the engineers of the state. A. S. Hovey, of Helena, is the secretary.

"Alas!" said the dray horse, sadly, "the saddle horse can afford to dine table d'oat, while I have to eat a la cart!"

No Fixed Rule.

"You cawn't set down no fixed rule o' conduct in this life," said old Wiggins, the Barley Mow orator. "Samson got into trouble 'cause he got 'is hair cut, an' Absalom got into trouble 'cause he didn't."—*London Tid-Bits.*

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International Convention Young Men's Christian Association, Mobile, Ala., April 26th—28th, 1897.

International Conference of German Secretaries, Y. M. C. A. Selma, Ala., April 26th—28th, 1897.

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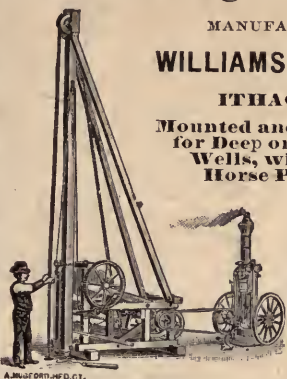
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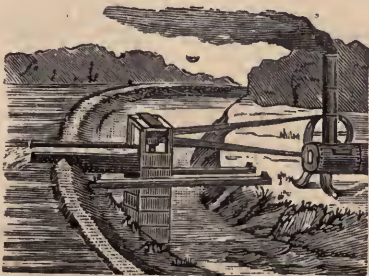
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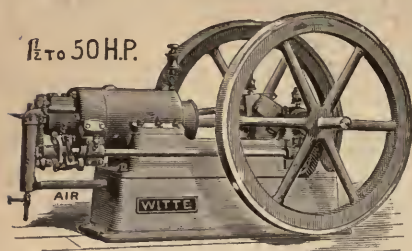
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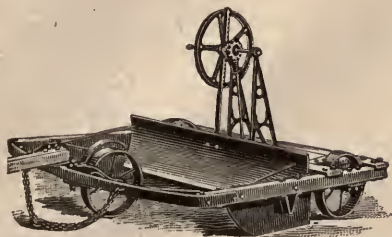
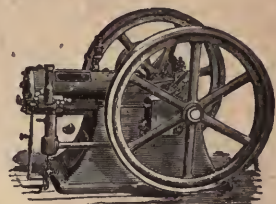
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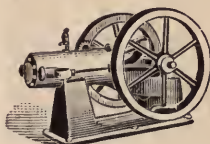
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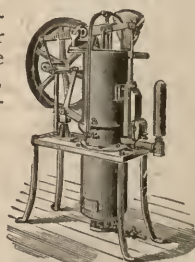
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The above is a reproduction from a kodak photograph, taken by Mr. I. A. Fort, President of the Nebraska State Irrigation Society, of a 12-foot Aermotor and Aermotor irrigation pump, owned by S. E. Beachler, Big Springs, Neb. (See testimonial below.)

Fills a Lake 150 feet in diameter, $3\frac{1}{2}$ feet deep, in two days.

BIG SPRINGS, NEB., July 25, 1895.

AERMOTOR Co., Chicago, Ill.

Gentlemen.—Your inquiry of July 23d in regard to how I like my Aermotor mill and irrigating pump, also in regard to crops under irrigation, received. In reply, will say I am well pleased with crops and irrigating plant. My Aermotor is a 12-foot wheel, and have it attached to an 8-inch Aermotor irrigating pump, 20 feet long. My well is dug 5 feet in diameter, 10 feet to water, and 8 feet of water, so I have the pump 6 feet in water, and 4 feet above platform. In a good wind it keeps the well lowered 4 to 5 feet. It will pump $2\frac{1}{2}$ gallons at a stroke, and 80 to 40 strokes per minute.

My reservoir is 150 feet in diameter, and $3\frac{1}{2}$ feet deep. In an ordinary wind the pump will fill it in two days. With an 8-inch pump I can successfully irrigate 8 to 10 acres in general crops, or 25 to 30 acres in alfalfa. Intend to sow 5 to 10 acres alfalfa each year till I have 25 to 30 acres, which I consider your mill will irrigate when it is well rooted down. Had six acres sowed this spring, first cutting July 15th; also have 6 acres in corn, potatoes and garden truck which are doing nicely.

Yours truly,

S. E. BEACHLER.

N. B. A boom is thrown across the center to prevent the force of the waves from washing the banks.

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AERMOTOR Co., Kansas City, Mo.

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Respectfully,

W. E. MARTIN.

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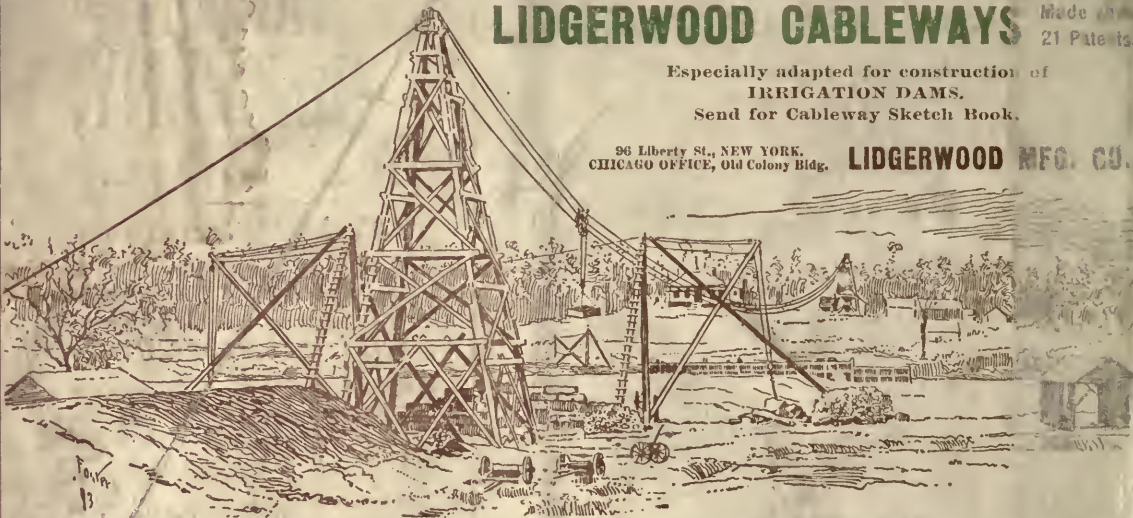
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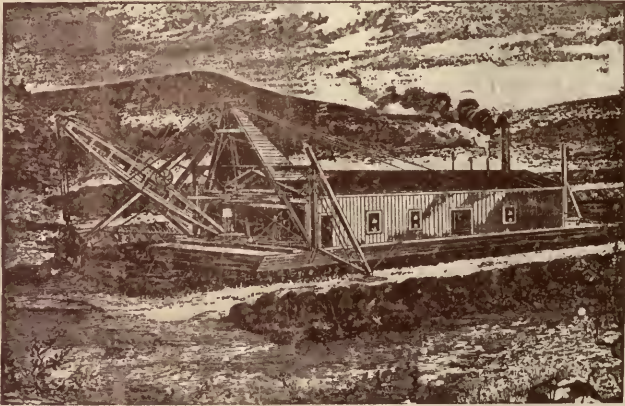
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